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PCBs, PBDEs, and Selected Metals in Spokane River Fish, 2005

June 2006 - DRAFT

Publication No. 06-03-025

Publication Information

This report is available on the Department of Ecology's website at
www.ecy.wa.gov/biblio/0603025.html

Data for this project are available on Ecology's Environmental Information Management (EIM) website at www.ecy.wa.gov/eim/index.htm. Search User Study ID, xxxx.

Ecology's Project Code for this study is 06-070.
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For more information contact:

Publications Coordinator
Environmental Assessment Program
P.O. Box 47600
Olympia, WA 98504-7600

E-mail: jlet461@ecy.wa.gov
Phone: (360) 407-6764

PCBs, PBDEs, and Selected Metals in Spokane River Fish, 2005

by
Dave Serdar and Art Johnson

Watershed Ecology Section
Environmental Assessment Program
Washington State Department of Ecology
Olympia, Washington 98504-7710

Waterbody Numbers:
QZ45UE
WA-57-1010 (Middle Spokane River)
WA-54-1010, WA-54-1020, WA-54-9040 (Lower Spokane River)

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Glossary of Acronyms, Symbols, and Units

Acronyms

Ecology –	Washington State Department of Ecology
ECD –	electron capture detector
EIM –	Environmental Information Management
EPA –	U.S. Environmental Protection Agency
GC –	gas chromatography
ICP –	inductively coupled argon plasma
MEL –	Manchester Environmental Laboratory
MS –	mass spectrometry
NTR –	National Toxics Rule
QC –	quality control
PBDE –	polybrominated diphenylether
PCB –	polychlorinated biphenyl
PCDD –	polychlorinated dibenzo-*p*-dioxin
PCDF –	polychlorinated dibenzofuran
RM –	river mile
RPD –	relative percent difference
SRHD –	Spokane Regional Health District
TCDD –	tetrachlorodibenzo-*p*-dioxin
TEQ –	toxic equivalent
TMDL –	Total Maximum Daily Load
WDFW –	Washington Department of Fish and Wildlife
WDOH –	Washington Department of Health
WSTMP –	Washington State Toxics Monitoring Program
ww –	wet weight

Symbols

As – arsenic
Cd – cadmium
Pb – lead
Zn – zinc

Units

mg/Kg – milligrams per kilogram (parts per million)
ug/Kg – micrograms per kilogram (parts per billion)
ng/Kg – nanograms per kilogram (parts per trillion)

Abstract

In order to obtain up-to-date information on chemical contaminants in Spokane River fish, we analyzed concentrations of polychlorinated biphenyls (PCBs), polybrominated diphenylethers (PBDEs), and selected metals (arsenic, cadmium, lead, and zinc) in several species of sport fish and bottom fish from six locations. The primary objective was to assist in the evaluation of possible tissue trends over time based on previous studies and to provide data to the Spokane Regional Health District and the Washington State Department of Health to assess if a review or revision to the current public health fish consumption advisory stemming from data collected in 1999 and 2001 is warranted. This report includes an evaluation of evidence for spatial and temporal trends and puts the results in statewide perspective.

Acknowledgements

We thank:

- John Roland, Ken Merrill, and Dale Norton for reviewing the report.
- Paul Anderson, Casey Deligeannis, Craig Graber, Ken Merrill, and Jeremy Ryf for help collecting fish.
- Darren Alkire, Brandee Era-Miller, Kristin Kinney, and Patti Sandvik for assisting with sample preparation.
- Pam Covey and Will White for keeping samples on track.
- Myrna Mandjikov, Dean Momohara, and Dolores Montgomery for performing the laboratory analyses.

Background

Problem Description

Contamination of the Spokane River with polychlorinated biphenyls (PCBs), toxic metals, and other chemicals has been documented for over two decades (e.g., Hopkins et al., 1985; Ecology, 1995; Jack and Roose, 2002). In response to these problems, the Washington State Department of Ecology (Ecology) Toxics Cleanup Program (TCP) and Water Quality Program (WQP) have done extensive work to improve conditions at a number of contaminated sites in and along the river. (http://www.ecy.wa.gov/programs/tcp/sites/sites_information.html, http://www.ecy.wa.gov/programs/wq/tmdl/watershed/tmdl_info-ero.html).

There is currently an advisory issued by the Washington State Department of Health (WDOH) and the Spokane Regional Health District (SRHD) to avoid or limit consumption of fish in parts of the Spokane River due to elevated PCB levels (Appendix A; http://www.srhd.org/downloads/safety_environment/SpokaneRiverFishAdvisory.pdf). The advisory - issued in 2003 - recommends against any consumption of fish between the Idaho border (river mile [RM] 96.1) and Upriver Dam (RM 80.2). For the reach between Upriver Dam and Ninemile Dam (RM 80.2-RM 58.1), WDOH advises against eating more than one meal per month of any species. The fish downstream of Ninemile Dam are deemed safe to eat.

Bottom sediments in much of the river are contaminated with high levels of arsenic, zinc, lead, and cadmium (Johnson and Norton, 2001). WDOH and SRHD have issued an advisory for people to reduce exposure to shoreline sediments along parts of the river due to the arsenic and lead concentrations (Appendix A; http://www.srhd.org/downloads/safety_environment/ShorelineSoilsAdvisories.pdf). In 2000 SRHD issued a fish consumption advisory due to lead (Duff, 2001), which was superseded by the current fish consumption advisory.

Total maximum daily loads (TMDLs) are currently being developed for PCBs in the Spokane River (Serdar and Kinney, in prep.). Previously, TMDL recommendations have been made for allowable loadings of zinc, lead, and cadmium (Pelletier, 1998). The ecological implications of PCB and metals contamination in the Spokane River have been assessed by Johnson (2001) and Kadlec (2000), respectively.

Although the fish sampling for the 2003-2004 PCB TMDL was limited and not intended to be directly comparable to earlier studies or to be used for a health assessment, results suggested a downward trend and it was determined that an update of PCB concentrations in Spokane River fish was needed. In addition, several screening-level studies suggested other chemical contaminants may be a concern in Spokane River fish and warrant consideration in a health assessment. In particular, polybrominated diphenylethers (PDBEs) have been found at significant concentrations. Johnson and Olson (2001) reported total PBDEs ranging from 20 to 1,250 ug/Kg wet weight (ww) in three species of Spokane River fish, generally much higher than concentrations in fish from other parts of Washington (range 1 – 64 ug/Kg). PBDEs are used as flame retardants in foam cushions, electronics and other applications.

There are no water quality or fish tissue standards for PBDEs. However, concerns about increasing levels in the environment, bioaccumulative potential, and ability to cause neurologic development and reproductive effects in laboratory animals have prompted Washington State to develop a plan to reduce PBDE inputs to the environment (Peele, 2004).

Recent screening-level data also suggest concentrations of polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans (PCDD/Fs) could merit further investigation in the Spokane. A single rainbow trout fillet sample analyzed from Ninemile in 2003 had a tetrachlorodibenzo-*p*-dioxin (TCDD) toxic equivalent (TEQ) of 0.36 ng/Kg (Seiders et al., 2006 - draft). By way of comparison, the EPA National Toxics Rule (NTR) criterion for PCDDs/Fs is 0.07 ng/Kg TEQ. Although the NTR criterion is based on human health risks – one in a million excess lifetime cancer – it is used to assess water quality violations and is not a threshold for issuing public-health fish consumption advisories.

Objectives

This project is a survey of PCBs, PBDEs and selected metals in Spokane River fish conducted by Ecology's Environmental Assessment Program (EAP) at the request of TCP and WQP. Our primary objective was to provide high quality representative data to WDOH for use in a human health assessment and in reviewing the current fish consumption advisory stemming from data collected in 1999 and 2001. A secondary objective was to examine contaminant trends within the river system. In addition, some of the data are being used for an Ecology study of PBDE levels in Washington's lakes and rivers (Johnson et al., in prep.). Three Spokane River fish samples were also analyzed for PCDD/Fs through Ecology's Washington State Toxics Monitoring Program (WSTMP). Results from this analysis are not yet available, but will be reported separately by WSTMP.

This survey was conducted according to a Quality Assurance Project Plan prepared by EAP (Serdar, 2005).

Methods

Study Design

Study Area

We sampled one to four fish species each at six locations along the Spokane River during August-November, 2005 (Figure 1). Table 1 shows the reaches and species sampled; Appendix B includes more detail on sample locations. All samples were analyzed for PCBs (as Aroclor-equivalents), 12 PBDE congeners, zinc, lead, cadmium, arsenic, and percent lipids. Biological data for the individual specimens analyzed (length, weight, age, and sex) are available from the authors on request.

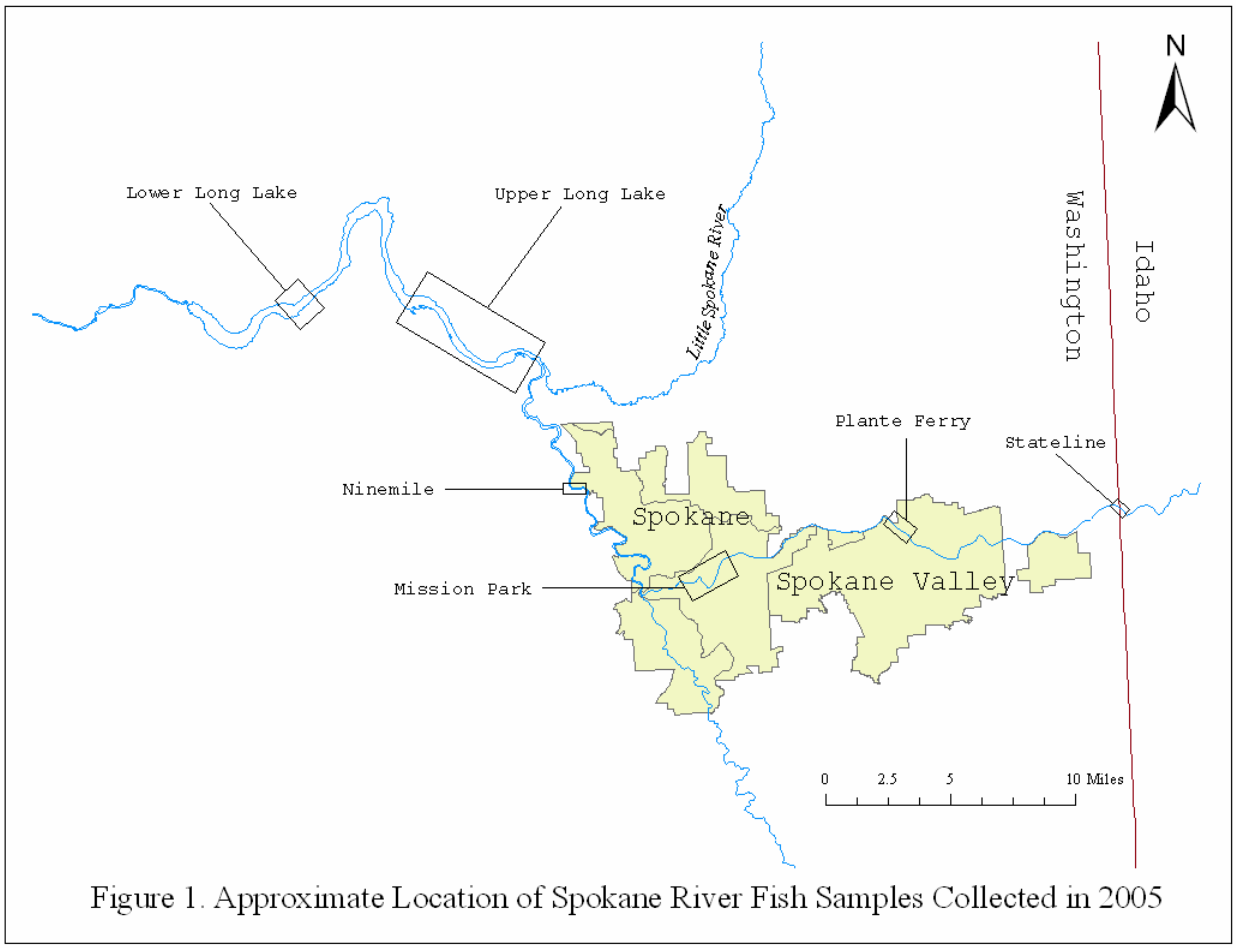


Figure 1. Approximate Location of Spokane River Fish Samples Collected in 2005

Table 1. Sampling Reaches and Species Analyzed for Spokane River 2005 Fish Study.

Reach	Approximate River Mile	Species
Stateline	96.1-95.5	Largescale sucker
Plante Ferry	86.0-85.0	Rainbow trout Largescale sucker
Mission Park	78.5-74.5	Rainbow trout Mountain Whitefish Largescale sucker
Ninemile	64.5-63.5	Rainbow trout Mountain Whitefish Bridgelip sucker
Upper Long Lake (Spokane River)	56.3-50.6	Mountain whitefish Smallmouth bass Brown trout Largescale sucker
Lower Long Lake (Spokane River)	40.8-39.4	Mountain whitefish Smallmouth bass Largescale sucker

Target Species

Species selected for analysis were based primarily on availability, desirability to anglers, and analysis in previous contaminant studies on the Spokane River. Rainbow trout (*Oncorhychus mykiss*) and largescale suckers (*Catostomus macrocheilus*) are the most significant species targeted by anglers in the Stateline and Plante Ferry reaches of the Spokane River; mountain whitefish (*Prosopium williamsoni*) are absent here. Rainbow trout are normally absent from the Stateline reach during summer and fall, and we were unable to collect any.

We collected rainbow trout, mountain whitefish, and suckers in the Mission Park and Ninemile reaches. Largescale suckers were scarce in the Ninemile area, an unexpected finding since they are plentiful in all other reaches. Instead, we collected bridgelip suckers (*C. columbianus*). Long Lake supports a broader composition of species (but few rainbow trout). Mountain whitefish, smallmouth bass (*Micropterus dolomieui*), brown trout (*Salmo trutta*), and largescale suckers were collected

Sampling Procedures

Fish were captured using electroshocking or gill net. Specimens retained for analysis were killed with a blow to the skull, weighed to the nearest gram, measured to the nearest millimeter, and assigned a sample number. Individual specimens were double-wrapped in aluminum foil, placed in polyethylene bags, and transported on ice to Ecology headquarters where they were stored frozen at -18° C.

We prepared three composite samples of each species collected at each location for analysis. They were grouped by the total length of individual specimens, resulting in small, medium, and large fish samples. When ready for processing, fish were partially thawed and we removed scales, otoliths, or other appropriate structures for subsequent age determination by Washington Department of Fish and Wildlife (WDFW).

Composite samples of the homogenized tissues were prepared by methods described by EPA and Washington State Toxics Monitoring Program for screening level assessments of contaminants in fish tissue (EPA, 2000; Seiders, 2003). Briefly, we scaled sport fish, removed and weighed the fillets, which were then ground in a Kitchen-Aid® food processor. We then combined equal mass aliquots of tissue from five specimens and further homogenized the composite sample with two additional passes through the food processor.

Bottom fish were prepared in the same manner except they were sectioned and homogenized whole (scales on) in a Hobart commercial meat grinder. All homogenates were placed in two 4-oz. glass jars with Teflon lid liners and certificates of analysis, and stored frozen.

All resection was done with non-corrosive stainless steel implements, and personnel preparing samples wore non-talc polyethylene or nitrile gloves and worked on clean aluminum foil changed between samples. Equipment used for fish processing was cleaned between composite samples using Liquinox® detergent and hot tap water, followed by rinses with 10% nitric acid, deionized water, pesticide grade acetone, and pesticide grade hexane. All implements were air-dried in a fume hood before use.

Laboratory Analysis

All chemical analyses were conducted at the Ecology/EPA Manchester Environmental Laboratory (MEL). Target compounds, reporting limits, and analysis methods are listed in Table 2.

Table 2. Target Compounds, Reporting Limits, Analysis Methods

Analyte	Reporting Limit	Sample Preparation Method	Analysis Method
PCBs			
Aroclor-1016	1.9 – 2.3 ng/g ww	EPA 3540/3620/3665	GC/ECD, EPA 8082, MEL SOP #730002
Aroclor-1221	"	"	"
Aroclor-1232	"	"	"
Aroclor-1242	"	"	"
Aroclor-1248	"	"	"
Aroclor-1254	"	"	"
Aroclor-1260	"	"	"
Aroclor-1262	"	"	"
Aroclor-1268	"	"	"
PBDEs			
PBDE-47	0.22 ng/g ww	EPA 3540/3620/3665	GC/MS, EPA 8270, MEL SOP #730096
PBDE-66	"	"	"
PBDE-71	"	"	"
PBDE-99	"	"	"
PBDE-100	"	"	"
PBDE-138	"	"	"
PBDE-153	0.22 – 0.44 ng/g ww	"	"
PBDE-154	"	"	"
PBDE-183	0.44 ng/g ww	"	"
PBDE-184	"	"	"
PBDE-191	"	"	"
PBDE-209	1.1 – 2.8 ng/g ww	"	
Metals			
Arsenic	0.1 µg/g ww	EPA 3051	ICP/MS, EPA 200.8
Cadmium	"	"	"
Lead	"	"	"
Zinc	5.0 µg/g ww	"	"
Percent lipids	0.01% ww	--	Gravimetric, EPA 608.5

Data Quality

The QC procedures routinely used by MEL for chemical analyses were followed for this project. Case narratives are included in Appendix C. Measurement quality objectives for this project (Serdar, 2005) were met, except as noted below.

Organics

Due to previous data showing high PCB concentrations in samples from these locations, the samples were analyzed using extract volumes of 1 ml and 5 ml; many of the results were obtained from a combination of the two. These dilutions were done for both the PCB analysis and the PBDE analysis.

Interferences by the lipid/protein matrix of fish tissue were problematic in the Aroclor analysis. This was especially pronounced in the continuing calibration, where matrix effects were thought to de-stablilize the stationary phase of the analytical column. There was also interference from DDE and DDT as well as interferences between Aroclors. As a result, some samples may be biased low for Aroclor 1260 and all Aroclor 1254 may be biased high. The case narrative contains more detail on the analytical problems encountered.

PCB matrix spikes had recoveries within acceptance limits except for one high spike recovery for Aroclor 1260. Most of the surrogate recoveries were within acceptable limits, although recoveries were generally higher than for a typical analysis. All laboratory control samples were within acceptable limits. No PCBs were detected in method blanks.

Five samples were analyzed in duplicate for PCBs to obtain an estimate of laboratory precision. Relative percent differences (RPDs, the difference between duplicate results divided by the mean of the duplicates) averaged for the five duplicate pairs were 7%-38%.

For PBDEs, all but three matrix spike recoveries were within acceptable ranges except where native analyte concentrations were high. The three cases outside the acceptable limits had recoveries of 44%-49%. Initial and continuing calibration responses met criteria with the exception of an increased PBDE-209 response on several occasions, but this appeared to have no effect on the results. All laboratory control samples and internal standards were within acceptable recovery limits. All surrogate recoveries fell within acceptable QC recovery limits except in cases where dilutions resulted in concentrations below the calibration range. No PBDEs were detected in method blanks.

Five samples were analyzed in duplicate for PBDEs. RPDs averaged for the five duplicate pairs were 19%-41%.

Metals

Matrix spikes recoveries were within acceptable ranges except where native analyte concentrations were high. Calibration checks were within control limits and laboratory control sample recoveries with within the acceptable range. Analyses of a certified reference material (NRCC; DORM-2, dogfish muscle) had average recoveries of 111% for arsenic and 115% for zinc. Lead and cadmium were below reporting limits or not certified. No metals were detected in method blanks.

Five samples were analyzed in duplicate for metals. RPDs were 14% for arsenic, 5% for cadmium, 15% for lead, and 13% for zinc, on average.

Results[1] and Discussion

PCBs

Table 3 summarizes the data obtained on PCB levels in Spokane River fish in 2005. Mean concentrations of total PCBs (sum of detected Aroclor-equivalents) ranged from 37 – 234 ug/Kg in sport fish fillets and 56 – 1,823 ug/Kg in whole largescale suckers. In both types of samples, concentrations gradually increased between the Stateline and Mission Park, then decreased from Mission Park down into lower Long Lake. The concentrations in Long Lake were higher than in the upper part of the river at Stateline and Plante Ferry.

Table 3. Summary of PCB Concentrations Measured in Spokane River Fish Collected in 2005

Location	Species	N* =	Total PCBs (ug/Kg, wet weight)	
			Mean	Range
Fillet Samples				
Plante Ferry	Rainbow Trout	3	55	48 - 68
Mission Park	Rainbow Trout	3	153	118 - 220
"	Mountain Whitefish	3	234	203 - 280
Ninemile	Rainbow Trout	3	73	46 - 94
"	Mountain Whitefish	3	139	86 - 172
Upper Long Lake	Mountain Whitefish	3	43	36 - 55
"	Brown Trout	1	130	- -
"	Smallmouth Bass	1	37	- -
Lower Long Lake	Mountain Whitefish	6	76	<9.6 - 190
"	Smallmouth Bass	3	67	49 - 82
Whole Body Samples				
Stateline	Largescale Sucker	3	56	16 - 77
Plante Ferry	Largescale Sucker	3	122	91 - 180
Mission Park	Largescale Sucker	3	1,823	1,100 - 3,000
Ninemile	Bridgelip Sucker	3	69	52 - 94
Upper Long Lake	Largescale Sucker	3	327	160 - 510
Lower Long Lake	Largescale Sucker	3	254	109 - 396

*Composites of 4-5 individual fish each, except lower Long Lake mountain whitefish were analyzed individually

[1] See Appendix D for the data on individual samples

Figure 2 illustrates the downstream trend in PCB concentrations. The data were also examined to determine if it would be appropriate to normalize to the lipid content of the samples, since concentrations of PCBs and other organochlorines sometimes vary directly with this parameter. For the majority of species and locations there was not a good correlation between total PCBs and percent lipids.

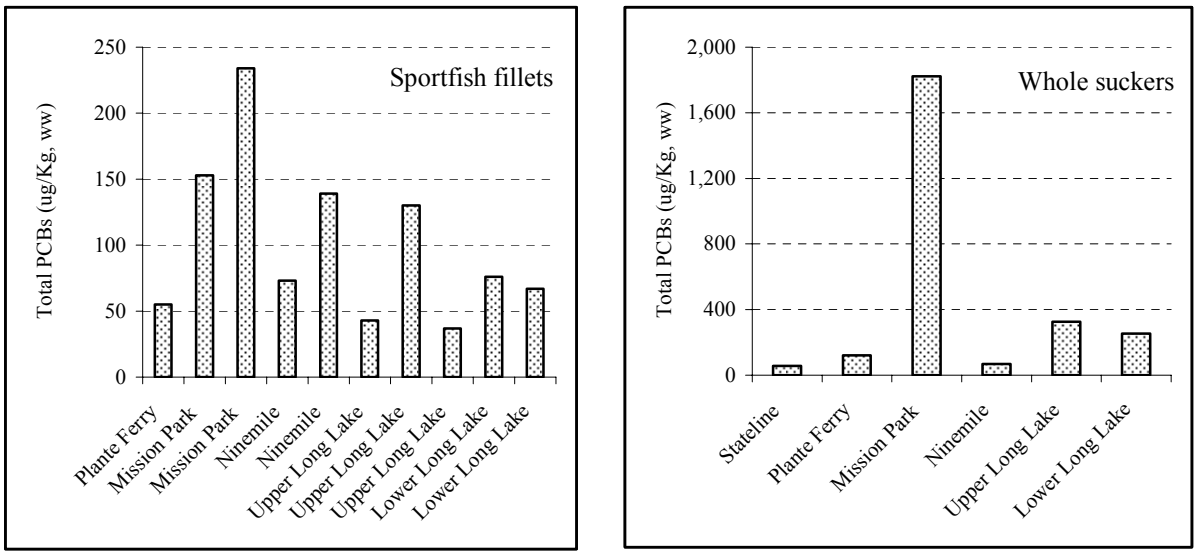


Figure 2. Mean Total PCB Concentrations in Spokane River Fish Samples Collected in 2005.

A series of graphs were prepared to examine historical PCB trends for each of the reaches where fish sampling efforts have been focused in the past. These data are for composite samples, except the individual fish data were plotted for the following: 1999 rainbow trout and mountain whitefish data for the Plante Ferry – Ninemile Reach;. 2003 rainbow trout data for the Ninemile reach; 2001 whole largescale sucker data for Long Lake; and 2005 mountain whitefish data for Lower Long Lake. Appendix D and E has the total PCB data for all Spokane River fish tissue samples analyzed by Ecology from 1993 up to the present study.

Sampling designs for many of these efforts are not appropriate for statistical testing for long-term trends. The studies often differ in sample size, use of composites vs. individual fish samples, and in other ways. Therefore a qualitative, weight-of- evidence approach was taken to identifying long-term changes in PCB levels, coupled with a statistical test for significant differences for the limited instances where comparable exist. Although percent lipids was poorly correlated with PCB concentrations, the lipid-normalized data were also examined and did not alter the general patterns seen on a wet weight basis.

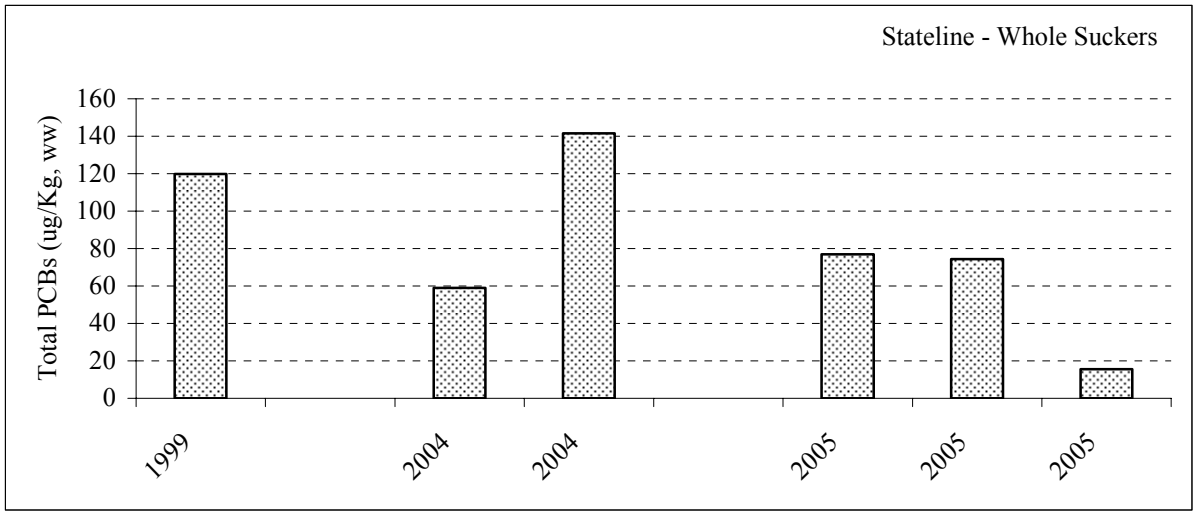
Stateline and Plante Ferry (Figure 3) – A substantial decrease in PCB levels appears to have occurred in both of these areas. The total PCB concentrations in whole suckers collected at Stateline in 2005 are approximately half those measured in 1999. There has been a consistent trend toward lower PCB concentrations in both rainbow trout fillets and whole suckers gathered near Plante Ferry. Between 1993 and 2005 total PCB concentrations decreased by one-to-two orders of magnitude. There is considerable variability in the Plante Ferry rainbow trout data for 1996 and 1999.

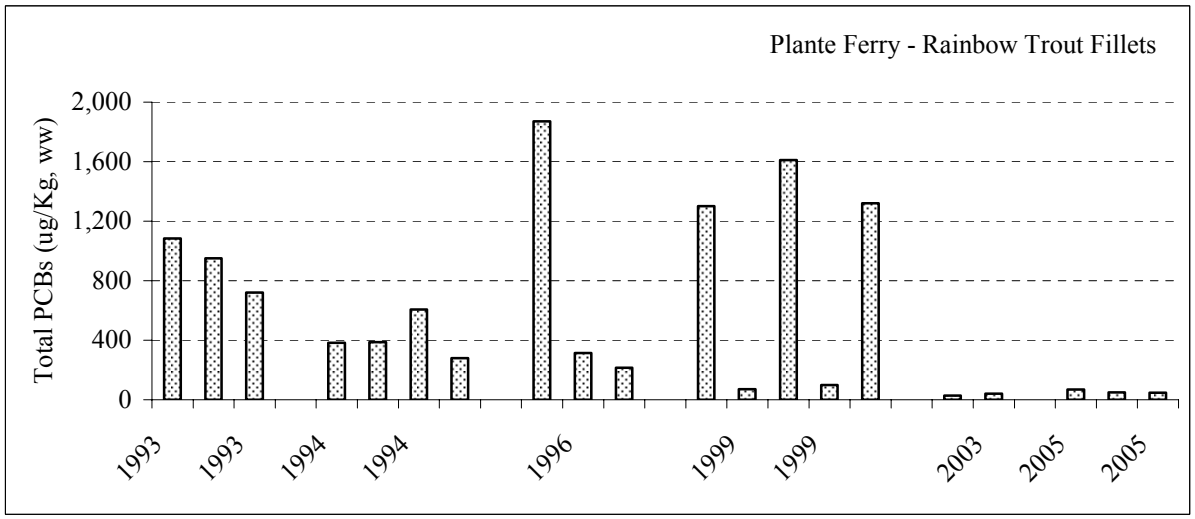
Mission Park (Figure 4) – Three data series are available for the Mission Park reach - rainbow trout fillets, mountain whitefish fillets, and whole suckers – and each supports a different conclusion as to whether PCB concentrations may be increasing or decreasing in this part of the river. Overall there is no strong evidence of improving conditions. The sucker data suggest a consistent, substantial increase between 1994 and 2005.

Ninemile (Figure 5) – As with Stateline and Plante Ferry, these data show total PCB concentrations in fish from the Ninemile reach have been decreasing over time. The levels observed during 2003 – 2005 are one-to-two orders of magnitude lower than during the 1990s.

Upper Long Lake (Figure 6) – The results for upper Long Lake are inconclusive, but this is likely due to the short time period represented by the data. PCB levels appear to have either decreased slightly (mountain whitefish fillets) or remained about the same (whole suckers).

Lower Long Lake (Figure 7) – The two long-term data sets available for lower Long Lake show a substantial decrease in total PCB levels in both mountain whitefish and largescale suckers.





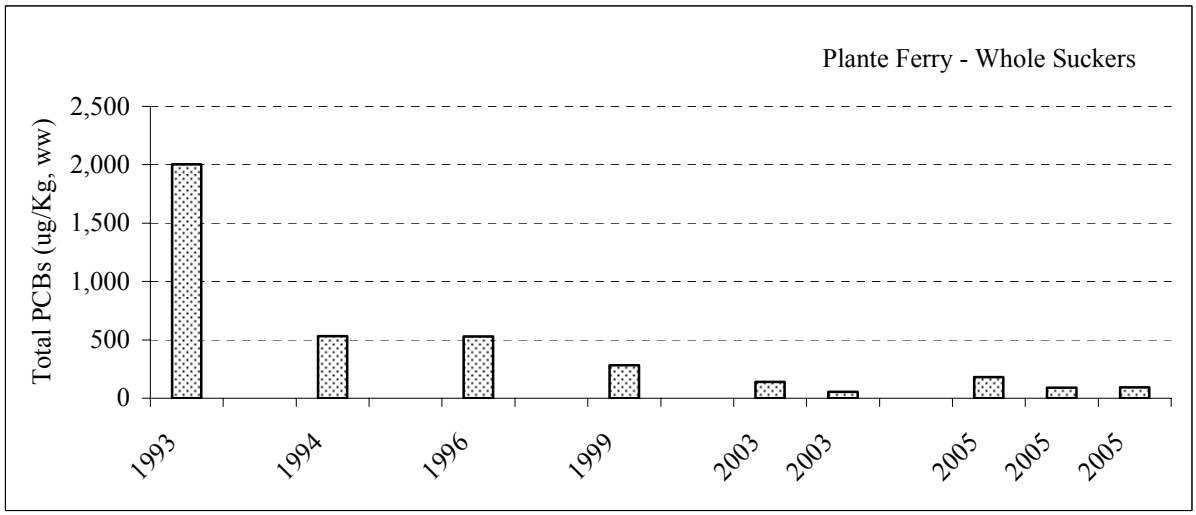
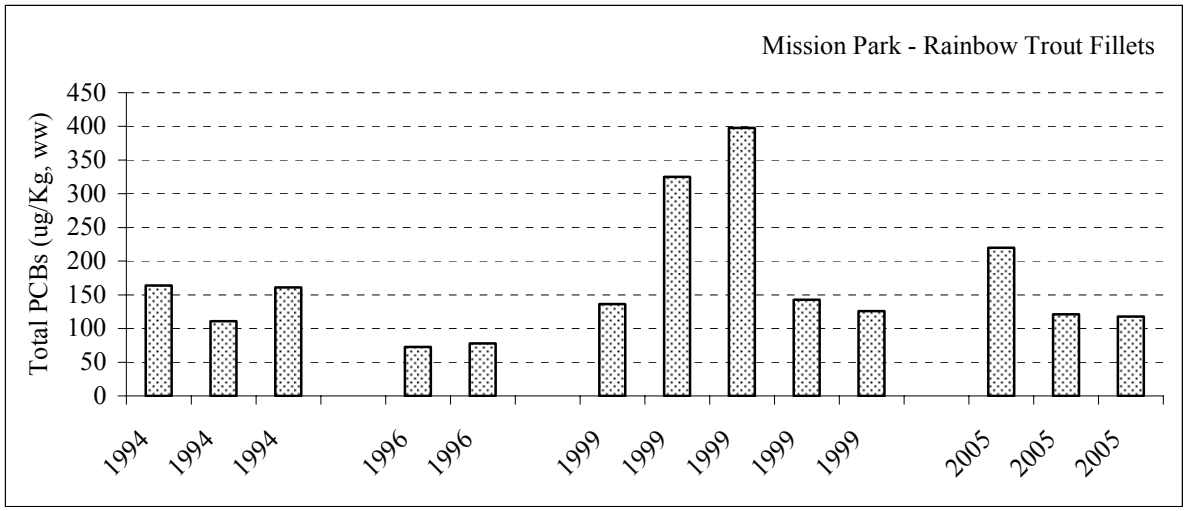
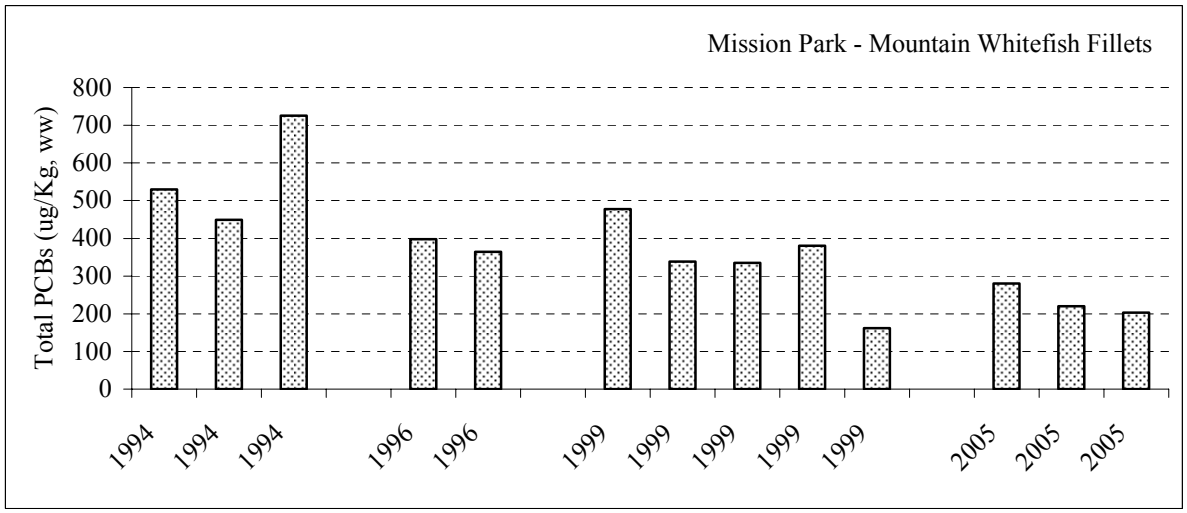


Figure 3. Historical Data on Total PCBs in Spokane River Fish: Stateline and Plante Ferry





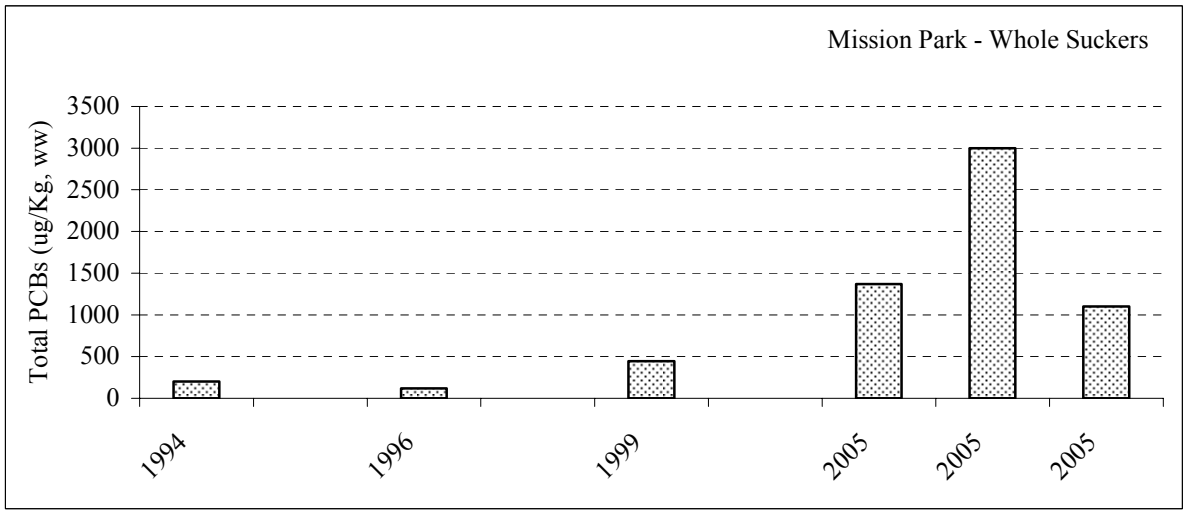
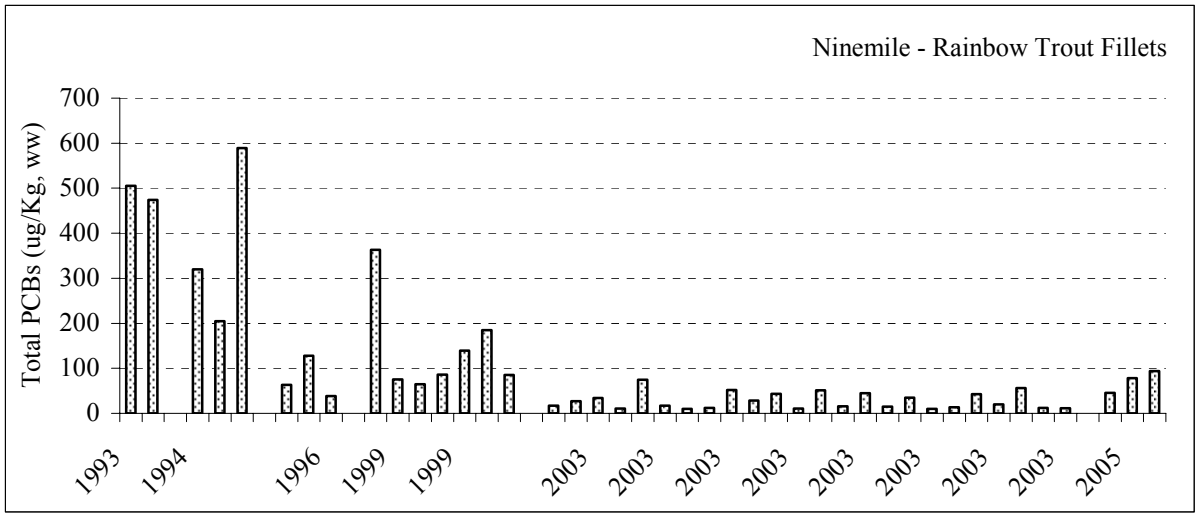
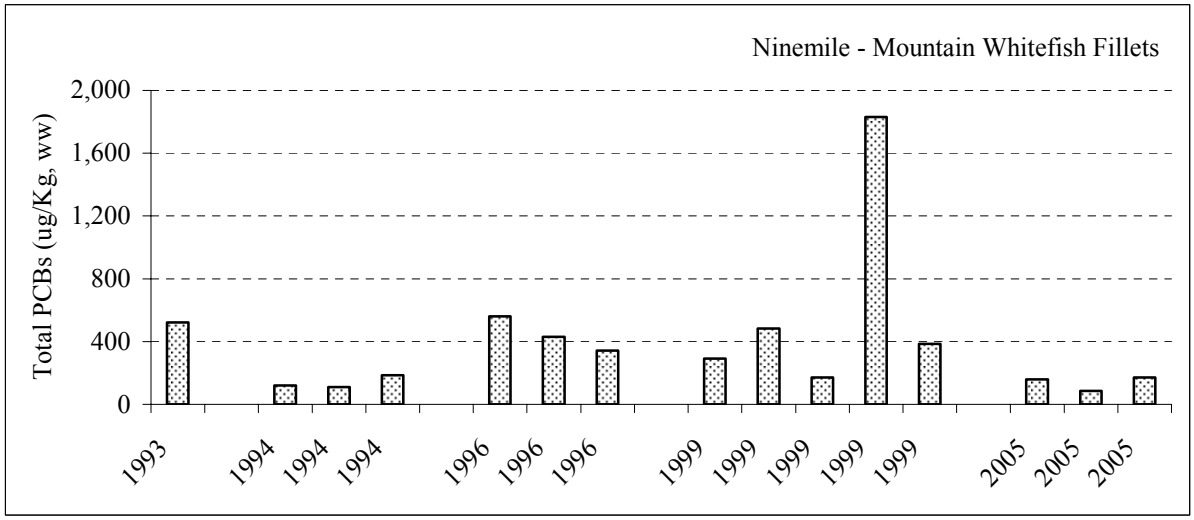


Figure 4. Historical Data on Total PCBs in Spokane River Fish: Mission Park





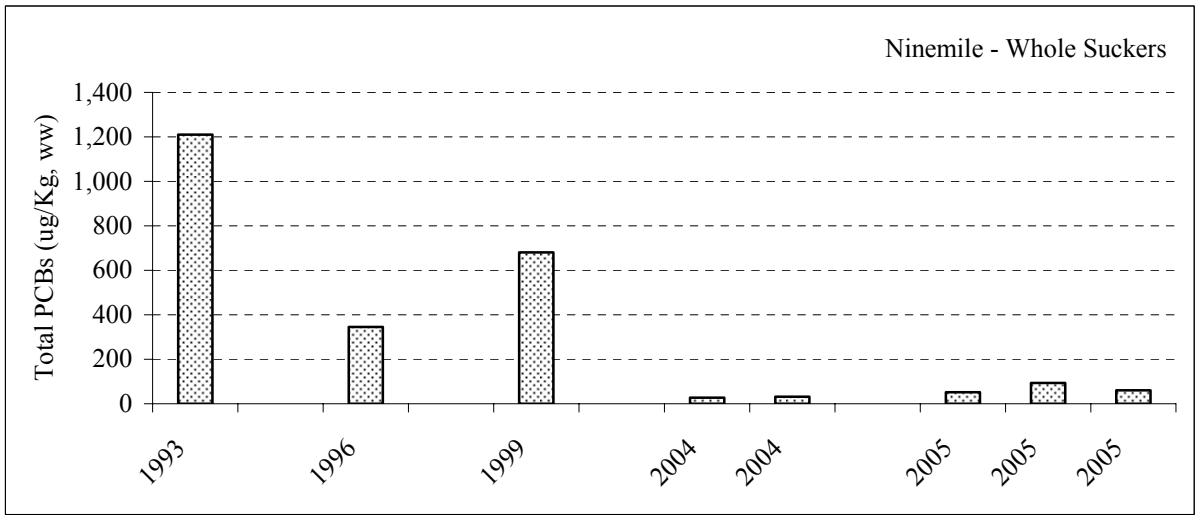


Figure 5. Historical Data on Total PCBs in Spokane River Fish: Ninemile

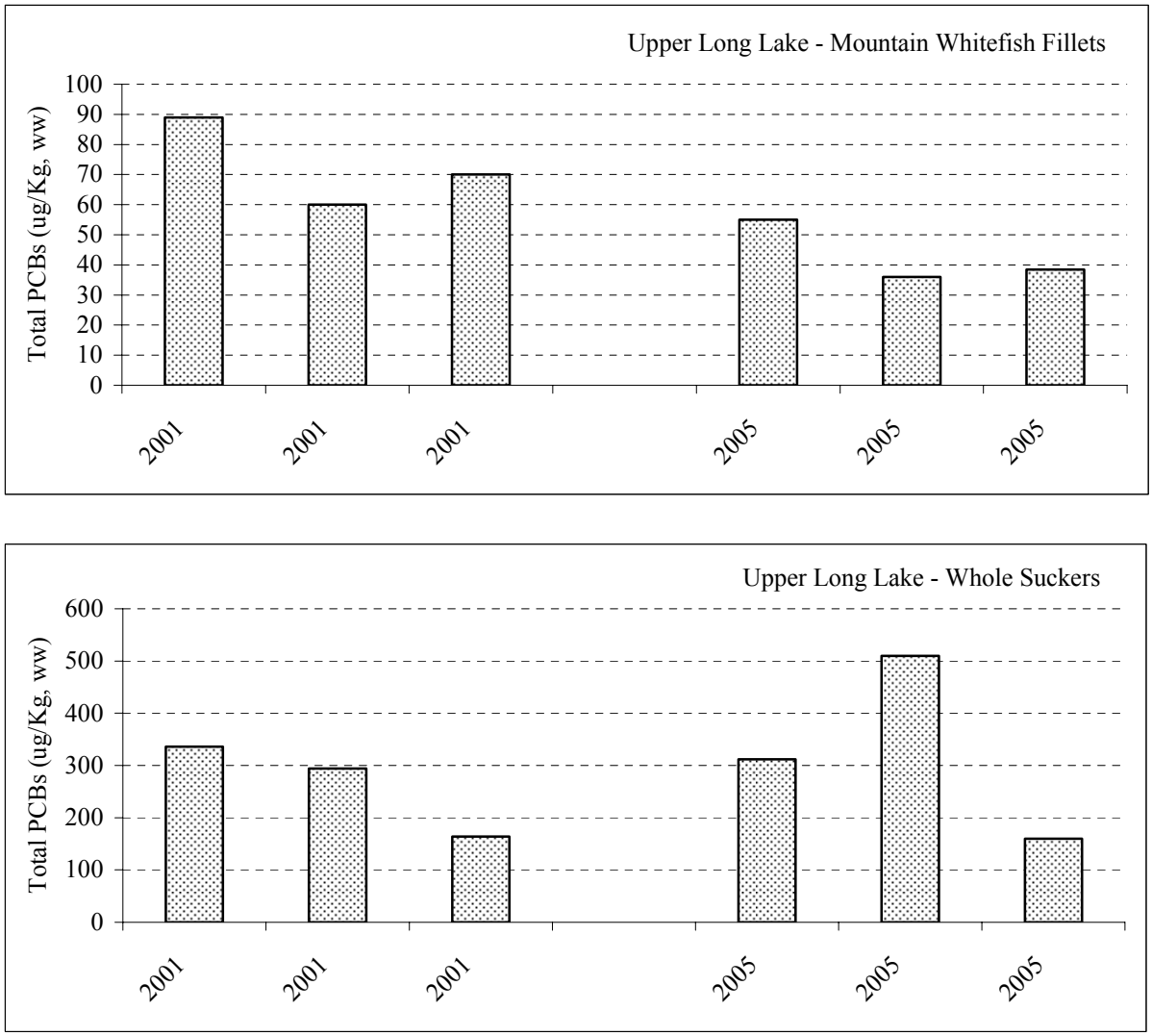
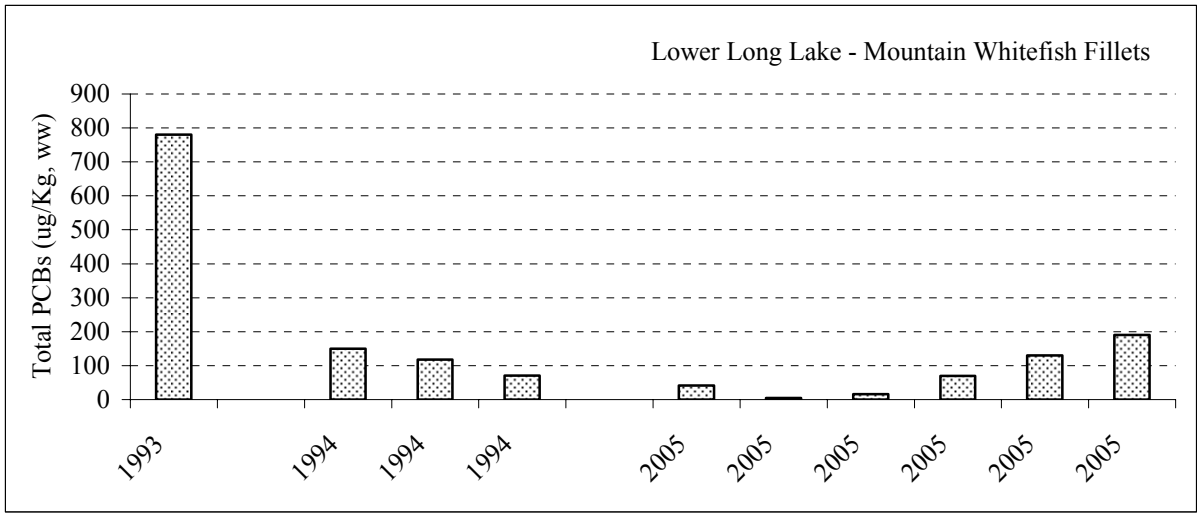
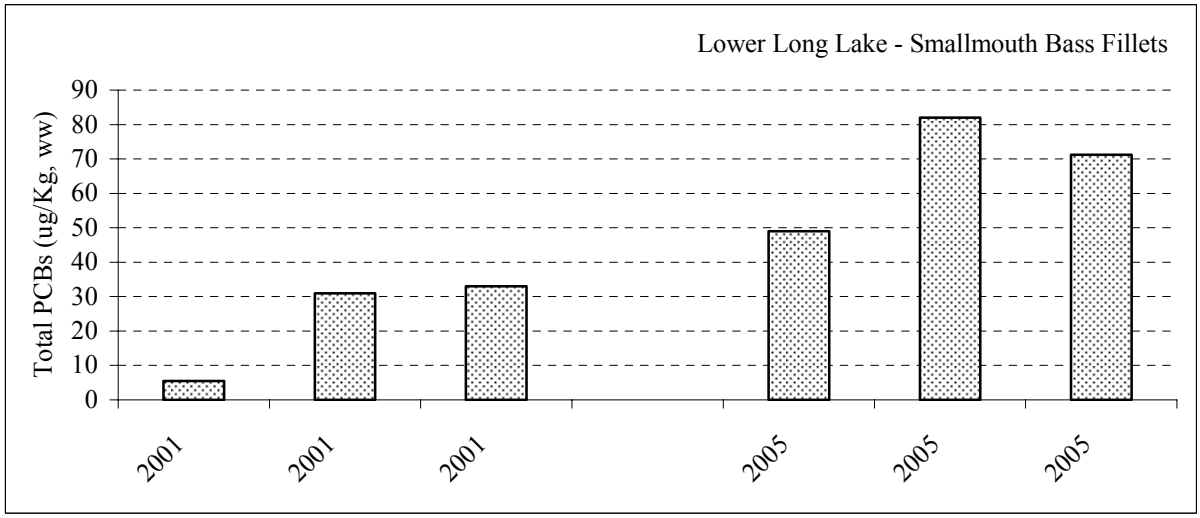


Figure 6. Historical Data on Total PCBs in Spokane River Fish: Upper Long Lake





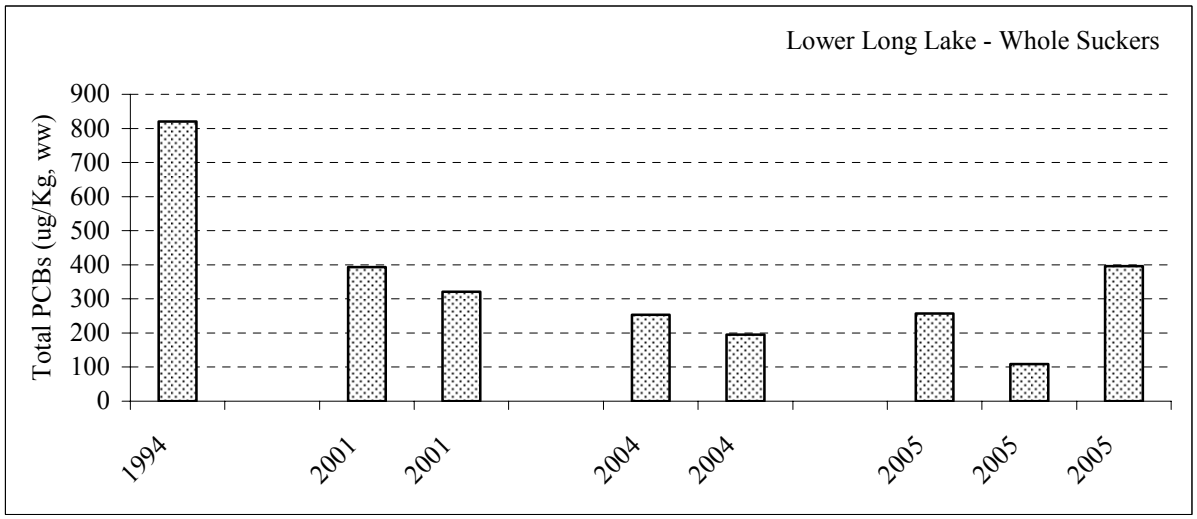


Figure 7. Historical Data on Total PCBs in Spokane River Fish: Lower Long Lake

Seven data sets were identified where the same fish species and tissues were analyzed for two or more time periods and where the sample size and type was sufficient for statistical analysis. The comparable data are for: composite rainbow trout fillets collected at Plante Ferry, Mission Park and Ninemile in 1994, 1996 and 2005; composite mountain whitefish fillets collected at Mission Park, Ninemile, and Upper Long Lake for the same years; and individual mountain whitefish fillets collected at Ninemile in 1996 and 2005 (Appendix D and E). Analysis of variance (ANOVA) was used to test for significant differences among the mean PCB concentrations measured in these samples. If the means were different, a Bonferroni post hoc test was used to determine which pairs (years) of samples differed significantly. A ninety percent or greater probability (p <0.10) was taken to be significant. The results are shown below in Table 4.

Table 4. Significant Changes Identified in Total PCB Concentrations in Spokane River Sportfish Fillets: Results of Analysis of Variance on Comparable Data Sets, 1994 - 2005.

Location	Species	Sample Type	Time Period	p value (Probability)	Significant Change? (p < 0.10)
Plante Ferry	Rainbow Trout	composites	1994-1996	1.00	No
"	"	composites	1996-2005	0.34	No
"	"	composites	1994-2005	0.01	Decrease
Mission Park	Rainbow Trout	composites	1994-2005	0.85	No
Mission Park	Mountain Whitefish	composites	1994-2005	0.02	Decrease
Ninemile	Rainbow Trout	composites	1994-1996	0.07	Decrease
"	"	composites	1996-2005	1.00	No
"	"	composites	1994-2005	0.06	Decrease
"	"	individuals	1996-2005	0.00	Decrease
Ninemile	Mountain Whitefish	composites	1994-1996	0.01	Increase
"	"	composites	1996-2005	0.01	Decrease
Upper Long Lake	Mountain Whitefish	composites	2001-2005	0.05	Decrease

Results of this analysis indicate that, at least for these two species, there has been a significant decrease in PCB concentrations between 1994 and 2005 for Plante Ferry, Ninemile, and Upper Long Lake. Evidence for a similar decrease in the Mission Park reach is equivocal, as was concluded from the qualitative time-series comparison (Figure 6). The general picture that

emerges from the historical data on the Spokane River is one of decreasing PCB concentrations in fish from all areas of the river except for Mission Park.

The measurable declines noted along the upper Spokane are consistent with recent Ecology regulatory and investigatory actions that are yielding reductions in PCBs entering the river from NPDES discharge and remedial actions associated with cleanup at a major industrial facility. Long Lake may also be responding to the actions taken in the upper river. The cause and significance of the apparent increases at in the Mission Park reach are unknown.

Table 5 compares the 2005 results with statewide data on PCBs in freshwater fish, based on fillet data reported by Seiders and Kinney (2004) and whole fish data in Davis et al. (1994, 95, 96, 98). The fillet data were primarily collected during the period 1995 – 2002; the whole fish data are from 1992 - 1995. To avoid biasing the statewide results high, data for Spokane River fish were excluded. The state-wide data set do not represent "background" sampling from waters generally free of anthropogenic influences, but are from various waters around the state including lakes, rivers, and streams impacted by industrial and municipal discharges.

For the most part, PCB concentrations in the 2005 Spokane River fillet samples are in the range of the statewide mean and median for fillets. The whole fish results for Mission Park and Long Lake are at or above the upper end of the range of whole fish statewide values. Exceedances of water quality standards and the environmental significance of the current level of PCB contamination in the Spokane River are addressed in the PCB TMDL and other studies cited at the beginning of this report.

Table 5. Total PCB Concentrations in Spokane River Fish vs. Statewide Data
(ug/Kg, wet weight)

	Spokane River 2005		Statewide*	
	Fillet	Whole Body	Fillet	Whole Body
N =	24	24	98	28
Mean	104	442	155	151
Median	78	135	28	87
Minimum	36	16	1.2	7.1
Maximum	280	3,000	1,943	622
90th percentile	213	1,181	297	334

*See text for data sources

PBDEs

The 2005 PBDE data on Spokane River fish are summarized in Table 6. Total PBDE concentrations (sum of detected compounds) ranged from means of 30 – 1,059 ug/Kg in sport fish fillets and 95 – 572 ug/Kg in whole largescale suckers. The primary PBDEs detected were PBDE-47, -99, and -100, which comprised approximately 90 percent of the total. Peak concentrations were observed at Ninemile and in upper Long Lake. Concentrations appeared to decrease in lower Long Lake. Figure 8 plots the data.

Table 6. Summary of PBDE Concentrations Measured in Spokane River Fish Collected in 2005

Location	Species	N* =	Total PBDEs (ug/Kg, wet weight)	
			Mean	Range
Fillet Samples				
Plante Ferry	Rainbow Trout	3	90	65 - 107
Mission Park	Rainbow Trout	3	30	27 - 32
"	Mountain Whitefish	3	368	355 - 391
Ninemile	Rainbow Trout	3	418	292 - 564
"	Mountain Whitefish	3	1,059	905 - 1,222
Upper Long Lake	Mountain Whitefish	3	175	161 - 198
"	Brown Trout	1	159	- -
"	Smallmouth Bass	1	42	- -
Lower Long Lake	Mountain Whitefish	6	122	56 - 228
"	Smallmouth Bass	3	57	34 - 92
Whole Body Samples				
Stateline	Largescale Sucker	3	198	169 - 214
Plante Ferry	Largescale Sucker	3	154	84 - 252
Mission Park	Largescale Sucker	3	95	90 - 98
Ninemile	Bridgelip Sucker	3	522	334 - 708
Upper Long Lake	Largescale Sucker	3	572	459 - 718
Lower Long Lake	Largescale Sucker	3	198	90 - 357

*Composites of 4-5 individual fish each, except lower Long Lake mountain whitefish were analyzed individually

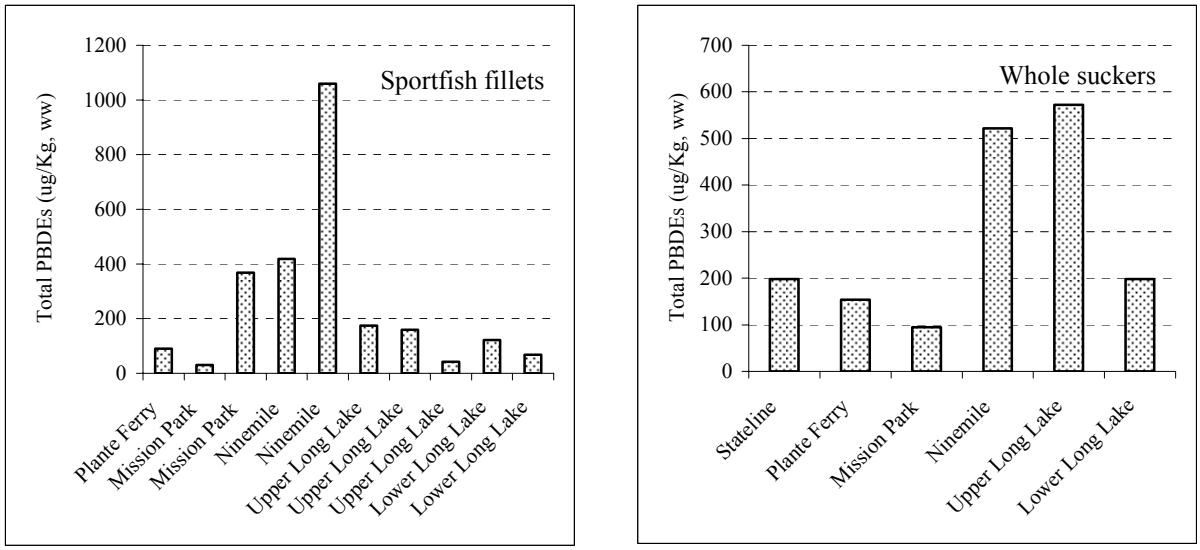


Figure 8. Mean Total PBDE Concentrations in Spokane River Fish Samples Collected in 2005

As previously described, elevated concentrations of PBDEs were first reported in Spokane River fish in 2001. A recently completed statewide survey by Ecology confirms that the Spokane River has much higher PBDE levels than other parts of the state sampled to date (Johnson et al., 2006, in prep.). Table 7 shows the currently available statewide fish tissue data, arranged approximately in order of increasing concentrations. When compared to these results, elevated PBDE concentrations in the Spokane River appear to extend up to Stateline.

As noted at the beginning of this report, PBDEs are an emerging human health concern. However, the significance of the PBDE levels observed in Spokane River fish, if any, is currently unknown.

Table 7. Selected Preliminary Data on PBDE Concentrations in Composite Fish Fillet Samples Collected from Washington Rivers and Lakes in 2005 (Johnson et al., 2006, in prep.)

Location	Species	Total PBDEs (ug/Kg, wet weight)
Fillet Samples		
Rock Lake	Largescale Sucker	ND
Queets River	Mountain Whitefish	ND
Sacajawea Lake (Longview)	Brown Bullhead	0.45
Bead Lake	Largescale Sucker	0.48
Lake Washington -North	Largescale Sucker	0.56
Potholes Reservoir	Largescale Sucker	0.68
Lake Chelan	Cutthroat Trout	0.14
"	Kokanee	1.0
Lake Whatcom	Brown Bullhead	1.2
Vancouver Lake	Largescale Sucker	2.3
Mayfield Lake	Largescale Sucker	2.6
Snake R. above Ice Harbor Dam	Largescale Sucker	4.5
Duwamish River	Northern Pikeminnow	5.6
Snohomish River	Largescale Sucker	11
Columbia R. near Kettle Falls	Rainbow Trout	0.92
"	Walleye	1.5
"	Largescale Sucker	9.8
"	Lake Whitefish	18
Columbia R. above McNary Dam	Yellow Perch	ND
"	Largescale Sucker	11
"	Common Carp	21
Yakima R. above Horn Rapids Dam	Common Carp	2.8
"	Smallmouth Bass	8.6
"	Northern Pikeminnow	9.3
"	Largescale Sucker	29
Columbia R. near Cathlamet	Largescale Sucker	31
Lake Washington -South	Largescale Sucker	31

ND = not detected

Zinc

The zinc results on Spokane River fish are summarized in Table 8. Both the fillet and whole fish samples show a trend toward decreasing zinc concentrations moving downstream from Stateline (Figure 9). Mean zinc levels in fillets declined from 12 – 15 mg/Kg in the upper river to 6.0 – 12 mg/Kg in Long Lake. Whole fish concentrations went from 79 – 114 mg/Kg to 24 mg/Kg over the same reach. A similar trend was first reported by Ecology in 1993 for zinc and other metals and attributed to mining sources in Idaho, as is well known (Johnson, 1994).

Table 8. Summary of Zinc Concentrations Measured in Spokane River Fish Collected in 2005

Location	Species	N* =	Zinc (mg/Kg, wet weight)	
			Mean	Range
Fillet Samples				
Plante Ferry	Rainbow Trout	3	15	12 - 17
Mission Park	Rainbow Trout	3	12	9.9 - 14
"	Mountain Whitefish	3	13	13 - 14
Ninemile	Rainbow Trout	3	10	8 - 12
"	Mountain Whitefish	3	12	11 - 13
Upper Long Lake	Mountain Whitefish	3	12	9.3 - 16
"	Brown Trout	1	6.0	--
"	Smallmouth Bass	1	7.8	- -
Lower Long Lake	Mountain Whitefish	6	7.1	6.3 - 8.3
"	Smallmouth Bass	3	8.3	7.8 - 8.8
Whole Body Samples				
Stateline	Largescale Sucker	3	114	87 - 165
Plante Ferry	Largescale Sucker	3	79	71 - 93
Mission Park	Largescale Sucker	3	56	54 - 58
Ninemile	Bridgelip Sucker	3	72	57 - 89
Upper Long Lake	Largescale Sucker	3	41	25 - 62
Lower Long Lake	Largescale Sucker	3	24	18 - 31

*Composites of 4-5 individual fish each, except lower Long Lake mountain whitefish were analyzed individually

The historical data on zinc and other metals in Spokane River fish are too limited to discern trends over time (Johnson et al., 1994; Serdar et al., 1994; Johnson, 2000; Jack and Roose, 2002). Hallock (2004) and others have analyzed the historical water quality data and identified trends in metals concentrations in the Spokane River.

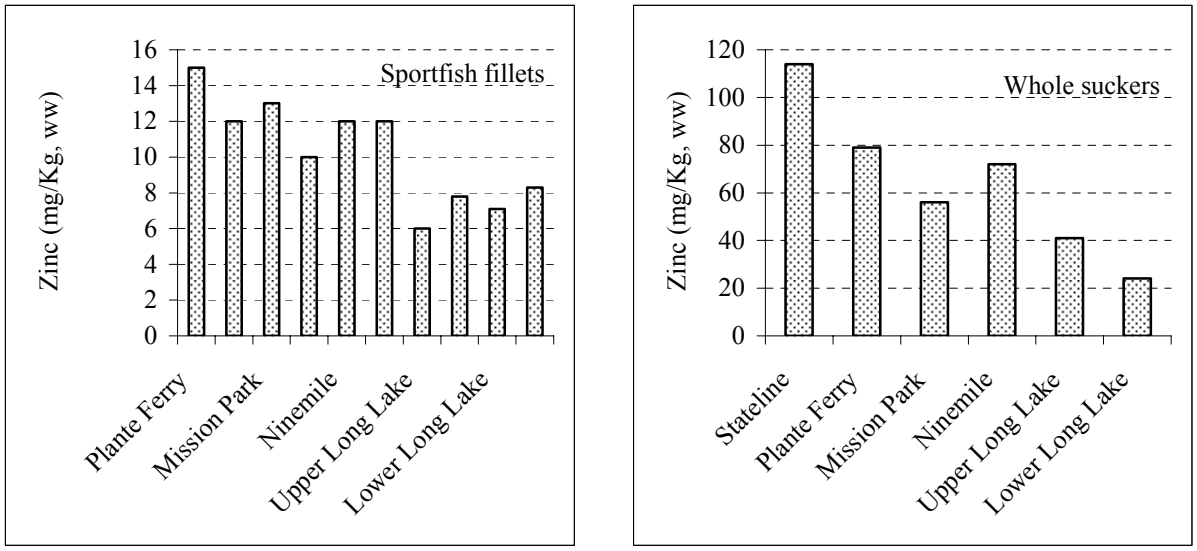


Figure 9. Mean Zinc Concentrations in Spokane River Fish Samples Collected in 2005.

As with PBDEs, there are no Washington State or EPA criteria for zinc or other metals in fish tissue. To put the metals results in perspective, a summary of concentrations reported for zinc, lead, cadmium, and arsenic in Washington freshwater fish was prepared from the data in Ecology's Environmental Information Management System (http://www.ecy.wa.gov/eim/). Results for the Spokane River and for Lake Roosevelt, which also has significant metals contamination, were not included. Some studies had high detection limits for lead, cadmium, and arsenic, and these were disregarded. As with the statewide data on PCBs presented earlier, the zinc data are from a variety of waterbodies around the state and include areas affect by industrial and municipal discharges and other metals sources. The bulk of the data come from Columbia River Basin Fish Contaminant Survey of 1996-98 (EPA, 2002).

The statewide zinc data are summarized in Table 9 and compared to the 2005 data for the Spokane River. By this comparison, zinc levels in most of the fillet samples from Plante Ferry down to Ninemile (10 – 15 mg/Kg on average) appear slightly elevated. The zinc levels measured in whole fish samples from the Spokane in 2005 are substantially elevated from Stateline into upper Long Lake (41 – 114 mg/Kg on average).

Table 9. Zinc Concentrations in Spokane River Fish vs. Statewide Data (mg/Kg, wet weight)

	Spokane River 2005		Statewide*	
	Fillet	Whole Body	Fillet	Whole Body
N =	24	24	175	160
Mean	14	65	11	23
Median	12	60	8.2	22
Minimum	6.0	18	2.9	2.4
Maximum	71	165	37	40
90th percentile	16	91	19	32

*EIM download 4/25/06 (see text)

Lead

Table 10 has a summary of the lead results. Only the fillet samples from Plante Ferry had detectable amounts of lead, <1.0 – 0.14 mg/Kg. However, lead was detected in whole fish samples from all parts of the river, with mean concentrations ranging from 0.33 – 4.2 mg/Kg. As observed for zinc, there was a strong trend toward decreasing lead concentrations moving downstream from Stateline (Figure 10).

Table 10. Summary of Lead Concentrations Measured in Spokane River Fish Collected in 2005

Location	Species	N* =	Lead (mg/Kg, wet weight)	
			Mean	Range
Fillet Samples				
Plante Ferry	Rainbow Trout	3	0.12	<0.10 - 0.14
Mission Park	Rainbow Trout	3	<0.10	<0.10 - 0.14
"	Mountain Whitefish	3	<0.10	<0.10 - 0.19
Ninemile	Rainbow Trout	3	<0.10	<0.10 - 0.26
"	Mountain Whitefish	3	<0.10	<0.10 (all)
Upper Long Lake	Mountain Whitefish	3	<0.10	<0.10 (all)
"	Brown Trout	1	<0.10	- -
"	Smallmouth Bass	1	<0.10	- -
Lower Long Lake	Mountain Whitefish	6	<0.10	<0.10 (all)
"	Smallmouth Bass	3	<0.10	<0.10 (all)
Whole Body Samples				
Stateline	Largescale Sucker	3	4.2	2.6 - 6.7
Plante Ferry	Largescale Sucker	3	2.9	2.6 - 3.2
Mission Park	Largescale Sucker	3	3.5	2.8 - 4.2
Ninemile	Bridgelip Sucker	3	2.9	2.6 - 3.1
Upper Long Lake	Largescale Sucker	3	0.80	0.60 - 1.2
Lower Long Lake	Largescale Sucker	3	0.33	0.14 - 0.57

*Composites of 4-5 individual fish each, except lower Long Lake mountain whitefish were analyzed individually

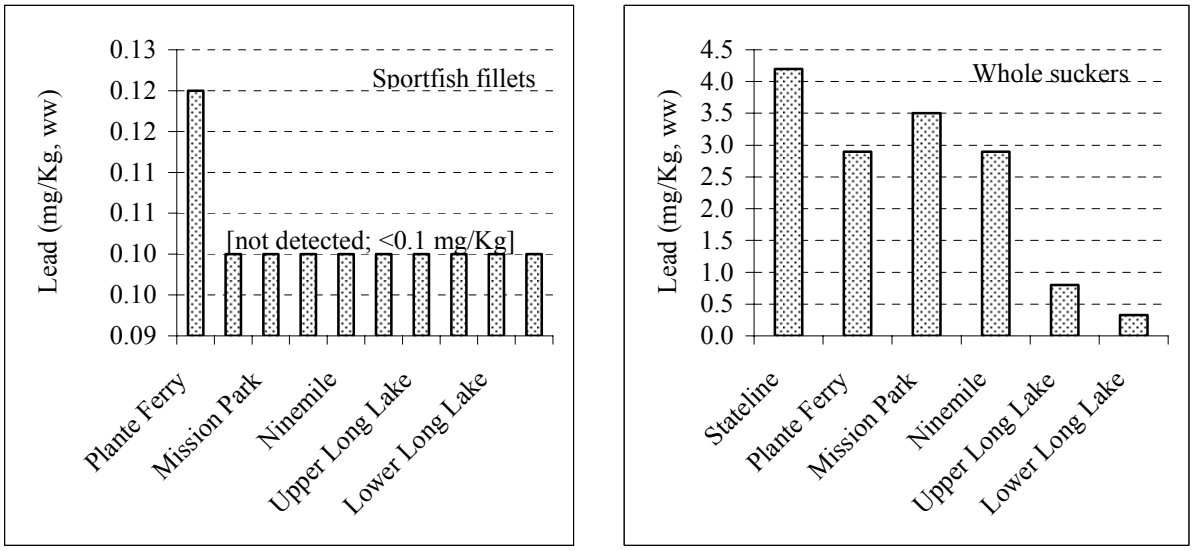


Figure 10. Mean Lead Concentrations in Spokane River Fish Samples Collected in 2005.

The statewide comparison for lead is shown in Table 11, using the same data sources previously described for zinc. Detection limits in most of the Spokane River fillet samples were not low enough for a useful comparison with statewide values. The lead concentrations in the Stateline fillet samples are clearly elevated. The lead levels in the Spokane whole fish samples are very high compared to elsewhere in the state.

Table 11. Lead Concentrations in Spokane River Fish vs. Statewide Data (mg/Kg, wet weight)

	Spokane River 2005		Statewide*	
	Fillet	Whole Body	Fillet	Whole Body
N =	24	24	152	149
Mean	0.28	2.4	<0.02	0.09
Median	<0.10	2.7	<0.01	0.031
Minimum	<0.10	0.14	<0.01	<0.01
Maximum	4.1	6.7	0.25	1.1
90th percentile	0.17	3.6	0.22	0.20

*EIM download 4/25/06 (see text)

Cadmium

The cadmium results are summarized in Table 12. Cadmium was only detected in the whole fish samples from the upper Spokane River (Stateline, Plante Ferry, and Mission Park) where the means ranged from 0.15 – 0.20 mg/kg. These levels are at the high end of the statewide range (Table 13).

Table 12. Summary of Cadmium Concentrations Measured in Spokane River Fish Collected in 2005

Location	Species	N* =	Cadmium (mg/Kg, wet weight)	
			Mean	Range
Fillet Samples				
Plante Ferry	Rainbow Trout	3	<0.10	<0.10 (all)
Mission Park	Rainbow Trout	3	<0.10	<0.10 (all)
"	Mountain Whitefish	3	<0.10	<0.10 (all)
Ninemile	Rainbow Trout	3	<0.10	<0.10 (all)
"	Mountain Whitefish	3	<0.10	<0.10 (all)
Upper Long Lake	Mountain Whitefish	3	<0.10	<0.10 (all)
"	Brown Trout	1	<0.10	- -
"	Smallmouth Bass	1	<0.10	--
Lower Long Lake	Mountain Whitefish	6	<0.10	<0.10 (all)
"	Smallmouth Bass	3	<0.10	<0.10 (all)
Whole Body Samples				
Stateline	Largescale Sucker	3	0.20	0.20 - 0.24
Plante Ferry	Largescale Sucker	3	0.20	0.17 - 0.24
Mission Park	Largescale Sucker	3	0.18	0.16 - 0.20
Ninemile	Bridgelip Sucker	3	0.15	0.13 - 0.18
Upper Long Lake	Largescale Sucker	3	<0.10	<0.10 (all)
Lower Long Lake	Largescale Sucker	3	<0.10	<0.10 (all)

*Composites of 4-5 individual fish each, except lower Long Lake mountain whitefish were analyzed individually

Table 13. Cadmium Concentrations in Spokane River Fish vs. Statewide Data (mg/Kg, wet weight)

	Spokane River 2005		Statewide*	
	Fillet	Whole Body	Fillet	Whole Body
N =	24	24	153	156
Mean	<0.10	0.16	0.01	0.05
Median	<0.10	0.16	<0.004	0.03
Minimum	<0.10	<0.10	<0.002	<0.004
Maximum	0.23	0.24	0.03	0.25
90th percentile	<0.10	0.21	0.01	0.14

*EIM download 4/25/06 (see text)

Arsenic

A summary of the arsenic data is in Table 14. The analysis was for total arsenic; arsenic species (i.e., inorganic vs. organic forms) were not determined.

Mean arsenic concentrations ranged from <0.10 to 0.31 mg/Kg in fillets and from 0.15 – 0.35 mg/Kg in whole fish. The fillet data suggest a downstream increase in arsenic, although species differences may be a contributing factor. There are no clear trends in the whole fish data. Arsenic levels in Spokane River fish do not appear elevated when compared to statewide data (Table 15).

Table 14. Summary of Total Arsenic Concentrations Measured in Spokane River Fish Collected in 2005

Location	Species	N* =	Arsenic (mg/Kg, wet weight)	
			Mean	Range
Fillet Samples				
Plante Ferry	Rainbow Trout	3	<0.10	<0.10 (all)
Mission Park	Rainbow Trout	3	<0.10	<0.10 (all)
"	Mountain Whitefish	3	<0.10	<0.10 (all)
Ninemile	Rainbow Trout	3	<0.10	<0.10 (all)
"	Mountain Whitefish	3	<0.10	<0.10 (all)
Upper Long Lake	Mountain Whitefish	3	<0.10	<0.10 - 0.12
"	Brown Trout	1	0.10	- -
"	Smallmouth Bass	1	0.11	- -
Lower Long Lake	Mountain Whitefish	6	0.31	0.23 - 0.38
"	Smallmouth Bass	3	0.13	0.10 - 0.16
Whole Body Samples				
Stateline	Largescale Sucker	3	0.20	0.16 - 0.24
Plante Ferry	Largescale Sucker	3	0.26	0.18 - 0.34
Mission Park	Largescale Sucker	3	0.26	0.16 - 0.33
Ninemile	Bridgelip Sucker	3	0.35	0.28 - 0.39
Upper Long Lake	Largescale Sucker	3	0.15	0.11 - 0.20
Lower Long Lake	Largescale Sucker	3	0.22	0.18 - 0.26

*Composites of 4-5 individual fish each, except lower Long Lake mountain whitefish were analyzed individually

Table 15. Total Arsenic Concentrations in Spokane River Fish vs. Statewide Data (mg/Kg, wet weight)

	Spokane River 2005		Statewide*	
	Fillet	Whole Body	Fillet	Whole Body
N =	24	24	140	145
Mean	0.13	0.24	0.44	0.45
Median	<0.10	0.24	0.38	0.37
Minimum	<0.10	0.11	<0.05	<0.05
Maximum	0.51	0.39	1.5	1.2
90th percentile	0.15	0.35	0.87	0.89

*EIM download 4/25/06 (see text)

Conclusions

Data on concentrations of PCBs, PBDEs, zinc, lead, cadmium, and arsenic have been obtained on sport fish and bottom fish from six locations in the Spokane River. This information has been provided to the Spokane Regional Health District and Washington State Department of Health for to assess if a review or revision to the current public health fish consumption advisory stemming from data collected in 1999 and 2001 is warranted. .

An examination of the fish tissue data revealed that peak concentrations occur in the Mission Park reach (PCBs), Ninemile and upper Long Lake (PBDEs), Stateline (zinc, lead, and cadmium), and Long Lake (arsenic - fillet samples only). Compared to historical levels, PCB concentrations in fish appear to have decreased in all parts of the Spokane River except the Mission Park reach.

Relative to freshwater fish in other parts of the state, the Spokane River has substantially elevated concentrations of PBDEs (both fillets and whole fish), as well as zinc, lead, and cadmium (whole fish samples only). PCB concentrations in whole fish - but not fillets - also remain relatively high compared to statewide data. Arsenic concentrations do not appear elevated in any of the 2005 Spokane fish samples.

Comparable data to evaluate recent trends in fish tissue contaminants in the Spokane is limited. Observations made from the 2005 data will need to be compared and more strongly validated by ongoing systematic monitoring to overcome natural variability and confirm changes over time.

Recommendations

1. The technical study for the recent Spokane River PCB TMDL did not identify the Mission Park reach as being more contaminated than other parts of the river. Additional sampling should therefore be conducted to verify that the high PCB concentrations seen in 2005 are representative of this reach. If the 2005 results are confirmed, sources should be identified and controlled. An upcoming study to monitor PCBs in city of Spokane stormwater, funded by an EAP grant to Ecology, may shed some light on this question.

2. In view of the emerging human health concerns associated with PBDEs and high concentrations observed in Spokane River fish, an investigation should be conducted to identify sources to the river. Results of the present study suggest there is a major source(s) in the Ninemile area and that there may also be significant sources in Idaho.

3. Periodic monitoring of Spokane River fish should continue to track the levels of PCBs, PBDEs, zinc, lead, cadmium and arsenic. The sampling frequency for PCBs will be addressed in the Submittal Report for the PCB TMDL and can be used as a guide for monitoring the other contaminants as well.

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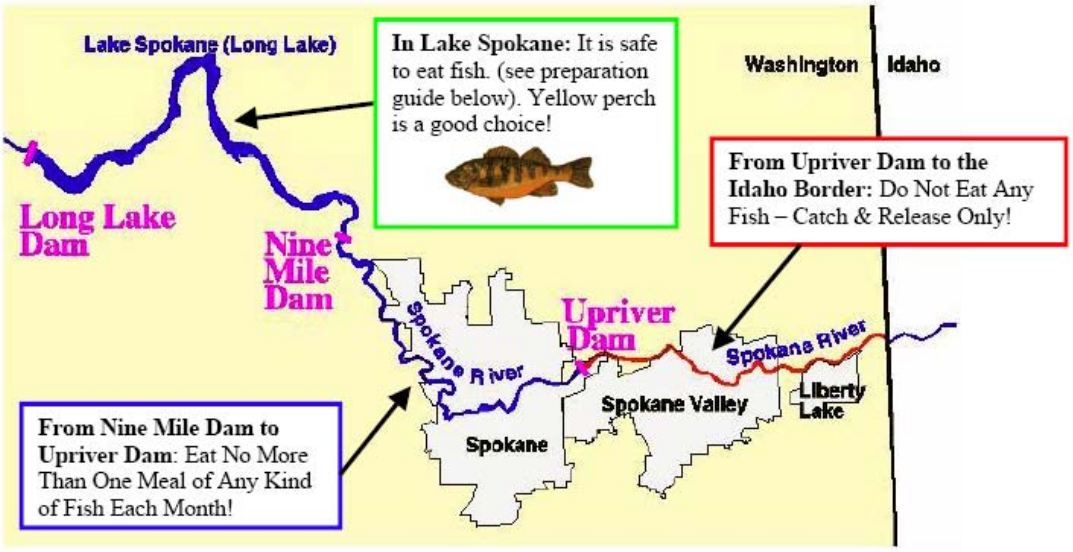
Appendices

Appendix A – Spokane River Health Advisories

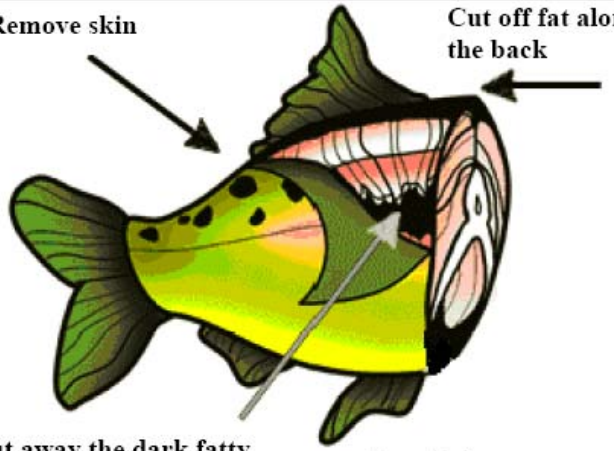
Spokane River Fish Meal Advisory

Issued July 2003

Spokane River fish contain chemicals called PCBs that can be harmful to your health. Fish from some parts of the river have more PCBs than others. Follow the advice given below if you eat fish from the Spokane River. Because PCBs can harm babies before they are born, women who are expecting a baby or planning to have babies should pay special attention to this warning.



Prepare Your Fish this way to Reduce Your Exposure to PCB's:



- Cook fish on a rack so the juices and fat will drip off.
- Do not eat the juices, bones, organs, fat, and skin.

For More Information Call Toll-Free: 1-877-485-7316
www.doh.wa.gov/ehp/oehas/EHA fish adv.htm
or
Contact the Spokane Regional Health District at:
(509) 324-1574
www.srhd.org

ATTENTION

LEAD AND ARSENIC IN SHORELINE SOILS

Frequent contact with shoreline soils along the Spokane River from State Line to Plantes Ferry Park may be unsafe, particularly for young children. Follow these steps to limit your exposure to lead and arsenic in these soils.

- **Avoid muddy soil that might cling to clothing, toys, or hands or feet.**
- **Wash your hands and face, especially before eating.**
- **Avoid dry, loose, or dusty soils that you might breathe.**
- **Wash anything that has come in contact with shoreline soils before entering your home.**

For more information contact the Spokane Regional Health District at:

(509) 324-1574

Appendix B – Sampling Locations

Table B. Sampling Stations for Spokane River 2005 Fish Study.

Reach	Station[a]	Description	Latitude[b] (dec. deg.)	Longitude[b] (dec deg.)	Species
Stateline	SPK 96.0	Spokane River near Idaho Stateline, River Mile 96.0	47.698322	117.044464	Largescale sucker
Plante Ferry	SPK 85.0	Spokane River near Plante Ferry, River Mile 85.0	47.694978	117.239903	Rainbow trout Largescale sucker
Mission Park	SPK 77.0	Spokane River near Greene Street, River Mile 77.0	47.676551	117.382298	Mountain Whitefish
"	SPK 75.2	Spokane River near Mission Street, River Mile 75.2	47.664007	117.404158	Rainbow trout Largescale sucker
Ninemile	SPK 64.0	Spokane River near Ninemile, River Mile 64.0	47.720434	117.500603	Rainbow trout Mountain Whitefish Bridgelip sucker
Upper Long Lake (Spokane River)	SPK 55.6	Spokane River near Upper Long Lake, River Mile 55.6	47.80089	117.548598	Mountain whitefish Smallmouth bass Largescale sucker
"	SPK 55.2	Spokane River near Upper Long Lake, River Mile 55.2	47.801558	117.557685	Brown trout
Lower Long Lake (Spokane River)	SPK 40.8	Spokane River near Lower Long Lake, River Mile 40.8	47.841521	117.724988	Smallmouth bass
"	SPK 40.1	Spokane River near Lower Long Lake, River Mile 40.1	47.834724	117.736628	Mountain whitefish Largescale sucker

[a] User Location ID in EIM
[b] NAD83 datum

Appendix C – Laboratory Case Narratives

Data Qualifier Codes

U	-	The analyte was not detected at or above the reported result.
J	-	The analyte was positively identified. The associated numerical result is an estimate.
UJ	-	The analyte was not detected at or above the reported estimated result.
REJ	-	The data are unusable for all purposes.
NAF	-	Not analyzed for.
N	-	For organic analytes there is evidence the analyte is present in this sample.
NJ	-	There is evidence that the analyte is present. The associated numerical result is an estimate.
NC	-	Not Calculated
E	-	The concentration exceeds the known calibration range.
bold	-	The analyte was present in the sample. (Visual Aid to locate detected compounds on report sheet.)

Manchester Environmental Laboratory
7411 Beach Dr E, Port Orchard, Washington 98366

Case Narrative
February 1, 2006

Subject: Spokane River Fish 2005

Samples: 05494230 - 05494277

Officer: Dave Serdar

By: M. Mandjikov

Polychlorinated Biphenyl (PCB) Analysis

Analytical Method(s)

The fish tissue samples were extracted into methylene chloride and hexane (50/50 v/v) using a Soxhlet apparatus. Following the extraction, each extract was solvent exchanged into hexane. These extracts were eluted through 2 gram micro Florisil® columns with a 6% v/v preserved diethyl ether/hexane solution. After Florisil treatment, each extract was solvent exchanged to iso-octane, concentrated to 1 mL, and treated with concentrated sulfuric acid prior to analysis.

All the extracts were analyzed using dual column GC-ECD. These methods are modifications of EPA SW- 846 methods 3540, 3620, 3665, and 8082.

Holding Times

All samples were prepared and analyzed within the method holding times.

Calibration

All relative standard deviations (RSD) between the calibration factors are less than 20%.

All initial calibration verification (ICV) standards are acceptable and within 15% of the theoretical value.

The typical continuing calibration range (CCV) for GC-ECD analysis is 85% - 115% recovery of the theoretical value. However, there are interfering compounds present in these fish tissue samples that affect the stability of the stationary phase of the analytical column resulting in less precise recoveries of the CCV. A statistical study was performed on the 23 CCV data points to provide the user with information regarding the precision of this analysis.

Analyte	Mean Recovery	-1 SD	+1 SD
Tetrachloro-m-xylene, Column A	102%	98%	106%
Tetrachloro-m-xylene, Column B	99%	92%	107%
Decachlorobiphenyl, Column A	92%	83%	101%
Decachlorobiphenyl, Column B	98%	88%	108%
Aroclor 1016, Column A	116%	88%	109%
Aroclor 1016, Column B	103%	91%	114%
Aroclor 1248, Column A	113%	101%	124%
Aroclor 1248, Column B	104%	94%	115%
Aroclor 1254, Column A	115%	102%	130%
Aroclor 1254, Column B	112%	99%	125%
Aroclor 1260, Column A	105%	94%	115%
Aroclor 1260, Column B	108%	99%	117%

All Tetrachloro-m-xylene CCV recoveries are within 85% - 115% of the theoretical spiked value.

All Decachlorobiphenyl CCV recoveries are within 3 times the standard deviation (SD) of the theoretical spiked value. However, four CCVs recovered below 85% of the theoretical spiked value. DCB is suppressed by high concentrations of lipids present in sample extracts and that is probably the reason for these low recoveries. Only Aroclor 1260 tends to show recovery suppression when DCB is affected. Therefore, the results of the 1260 Aroclor may be biased low in the following samples: 05494243 – 05494248, 05494251 – 05494260, 05494275, 05494277, their dilutions and QC samples.

All Aroclor 1248 results are reported from Column B. All CCV recoveries of this Aroclor are within 3 times the SD of the theoretical spiked value. However, two CCVs recover below 85% and three recoveries exceed 115%. Since the Aroclor 1248 CCV recoveries appear to follow Gaussian predictability, the control for this Aroclor is acceptable.

All Aroclor 1254 results are reported from Column A. All CCV recoveries of this Aroclor are within 3 times the SD of the theoretical spiked value. Results are reported from this column rather than column B due to the difficulty of isolating individual 1254 peaks from the interference of DDE, DDT, Aroclor 1248 and Aroclor 1260 peaks. Examination of the data reveals an increase in the system sensitivity of the Aroclor 1254 peaks selected for quantitation as the analysis progressed. This phenomenon seems to be isolated to Aroclor 1254 and does not appear to be caused by typical carryover contamination. Therefore, the Aroclor 1254 results should be used as biased high.

All Aroclor 1260 CCV recoveries are within 3 times the SD of the theoretical spiked value. Since the Aroclor 1260 CCV recoveries appear to follow Gaussian predictability, the control for this Aroclor is acceptable.

Blanks

There is no evidence of any target analyte detected in any of the blanks.

Surrogates

Per the QAPP the acceptable surrogate recoveries are 30% - 150%.

All the samples and QC samples were spiked with 100 ng of the surrogate compounds, Tetrachloro-m-xylene (TMX) and Decachlorobiphenyl (DCB). All the surrogate recoveries are acceptable and within the established QC limits, with the following exceptions: 05494246, 05494247, 05494250, and 05494271. Although the dilutions of 05494242, 05494264, and 05494266 have high recoveries of DCB, no action has been taken since the surrogate recoveries of the non-diluted samples are acceptable.

Most of the samples in this project contained significant amounts of lipids. The lipids were removed from the extract by treating the extract with concentrated sulfuric acid and centrifugation. After reacting with the acid, the lipids gravimetrically separate from the extract. In many of the samples, the majority of the extract was consumed, leaving only several hundred micro liters of solvent available for analysis. The samples with the least amount of remaining solvent tended to have high recoveries of surrogate (with the exceptions of 05494245, 05494246, and 05494247). This may be the explanation for the high recoveries of 05494250, and 05494271, although in general, the surrogate recoveries for this entire project are higher than typical analysis.

Samples 05494245, 05494246, and 05494247 have significantly low surrogate recoveries compared to the rest of the project. The standard clean up technique was not enough to remove the lipid interference from these extracts.

Re-extraction of samples 05494245, 05494246, 05494247, and 05494250 is recommended to improve the results.

Duplicates

Samples 05494230, 05494235, 05494245, 05494248, and 05494251 were prepared in duplicate to evaluate the precision of this method. Per the QAPP, the acceptable relative percent difference for duplicates is less than or equal to 50%. All sets of duplicates are acceptable with the exception of 05494245.

Matrix Spiked Samples

Samples 05494238, 05494242, 05494246, 05494256, 05494274, 05494276 were prepared in duplicate. One replicate of each sample was spiked with 500 ng of Aroclors 1016 and 1260. Per the QAPP, the acceptable matrix spike recoveries are 50-150% recovery.

The Aroclor 1260 spike recovery for sample 05494242 exceeds the acceptable limits. The result for this sample is qualified, "J" as an estimate.

The spiked replicate of sample 05494246 had unacceptable recoveries for the Aroclors and surrogates. Since the surrogate recoveries of the unspiked sample are acceptable, the results for this sample are probably valid. I have recommended that this sample be re-extracted due to the problems with the matrix spiked sample.

Laboratory Control Sample

Ten grams of analytically clean Ottawa sand was spiked with 500 ng of Aroclors 1016 and 1260 to provide a laboratory control sample (LCS) for this extraction batch. This sample was processed and analyzed identically to the rest of the project. All the LCS recoveries are within the acceptable limits of 50% - 150% set by the QAPP.

Comments

The ratios of PCB congeners present in fish tissue do not identically match the ratios as they are standardized with the commercial reference standards due to metabolic activity and/or weathering of the PCB Aroclors by the environment. There are also substantial interferences of DDT, PBDEs, and possibly Toxaphene present as well as the interferences of Aroclors 1016/1242, 1248, 1254, and 1260 upon each other.

These challenges combined with the increase in calibration control variability influenced by the lipid/protein matrix interference from fish tissue made it necessary to qualify all detected Aroclors as estimates, "J". Extreme effort was made to isolate Aroclor indicator peaks to provide good estimates of concentration.

Frequently, the concentration of one or more Aroclors was high enough to obscure the evidence of other Aroclors. When this occurred, the reporting limit was raised to a level above the interference and qualified, "UJ", as an estimated reporting limit. In cases where an interfering Aroclor added more than 50% bias to an Aroclor determined to be present, the lesser Aroclor was report undetected, "UJ", at the calculated result due to the uncertainty of concentration.

Re-extraction of samples 05494245, 05494246, 05494247, and 05494250 is recommended to improve the results. The re-extracted results for these samples will be reported at a later date.

Results reported over the calibration limit are qualified, "E", and should not be used. Use the result for the diluted sample.

Aroclors 1016 and 1242 are very similar in appearance and in fish tissue in the presence of Aroclor 1248, they appear identical. Therefore, all peak patterns that resemble these Aroclors are quantitated and reported as Aroclor 1016. The result for Aroclor 1242 is qualified as an estimated reporting limit, "UJ".

The matrix spiked sample, 05494242 LMX1 required dilution because Aroclor 1260 exceeds the calibration limit. The dilution of this matrix spiked sample is designated as 05494242 LMX2.

Manchester Environmental Laboratory
7411 Beach Dr E, Port Orchard, Washington 98366

Case Narrative

February 6, 2006

Subject: Spokane River Fish – Batch 1

Project No: 188005

Sample No: 05494230; 05494261 – 05494274; 05494276

Project Officer: Dave Serdar

By: Dolores Montgomery

Summary

The samples were analyzed using the following method: EPA method 8270 for PBDE analysis.

All analyses requested were evaluated by established regulatory quality assurance guidelines.

Holding Times

All samples were analyzed within the method holding times.

Tuning

Calibration against DFTPP is acceptable for the initial calibration and all associated sample analyses.

Initial Calibration

All compounds met minimum response factor criteria and had calibration curves which had %RSD ≤15, linear correlation coefficients of greater than 0.990, a coefficient of determination greater than 0.990 and had no standard vary from its true value by more than 20%.

Continuing Calibration

All compounds fell within ±20%D of the continuing calibration with the following exceptions. Target analyte PBDE 209 fell below the minimum requirement in continuing calibrations analyzed on January 10th and January 11th. PBDE 209 was not detected in any samples analyzed on those days and all non-detected results were qualified UJ. The samples qualified were 05494265, 05494268, 05494269, 05494270, 05494271, 05494272, 05494273, 05494274, and 05494276.

Method Blanks

No target analytes were detected in the method blanks.

Matrix Spikes

A matrix spike was performed on samples 05494274 and 05494276. All recoveries fell within the QC recovery limits of 50% - 150% and had RPD's ≤ 40% with the following exceptions. Recoveries for PBDE 47 and PBDE 99 were not able to be calculated in sample 05494274(LMX1) due to the high levels of the analytes found in the native sample. Recoveries for PBDE 49, PBDE 47, and PBDE 99 were not obtainable in sample 05494276 due to the high levels of the analytes present in the native sample.

Laboratory Control Sample

LCS sample OL05364T1 was analyzed with the sample set. All compounds met established QC recovery guidelines of 70% - 130%.

Surrogates

All surrogates fell within established QC recovery limits of 50% - 150%.

Internal Standards

All internal standards fell within established QC limits of 50% - 200%.

Laboratory Duplicates

Sample 05494230 was utilized for duplicate analysis. All detected compounds had RPD's ≤40 with the following exceptions. PBDE 47, PBDE 100, and PBDE 99 had RPD's of 49, 50, and 48 respectively. The differences are probably the result of a non-homogenous sample. Results for PBDE's 47, 100, and 99 were qualified J in sample 05494230.

Please call Dolores Montgomery at (360) 871-8818 to further discuss this project.

cc: Project File

Manchester Environmental Laboratory
7411 Beach Dr E, Port Orchard, Washington 98366

Case Narrative

February 7, 2006

Subject: Spokane River Fish – Batch 2

Project No: 188005

Sample No: 05494231 – 05494242; 05494246; 05494249, 05494250

Project Officer: Dave Serdar

By: Dolores Montgomery

Summary

The samples were analyzed using the following method: EPA method 8270 for PBDE analysis.

All analyses requested were evaluated by established regulatory quality assurance guidelines.

Holding Times

All samples were analyzed within the method holding times.

Tuning

Calibration against DFTPP is acceptable for the initial calibration and all associated sample analyses.

Initial Calibration

All compounds met minimum response factor criteria and had calibration curves which had %RSD ≤15, linear correlation coefficients of greater than 0.995, a coefficient of determination greater than 0.99 and had no standard vary from its true value by more than 20%.

Continuing Calibration

All compounds fell within ±20%D of the continuing calibration.

Method Blanks

No target analytes were detected in the method blanks.

Matrix Spikes

Matrix spikes were performed on samples 05494238, 05494242, and 05494246. All recoveries fell within the QC recovery limits of 50% - 150% and had RPD's ≤ 40% with the following exceptions. Recoveries for PBDE 138 and PBDE 184 were low in sample 05494246(LMX1) with recoveries of 45% and 49% respectively. Neither analyte was detected in the native sample and non-detects were qualified UJ. Recoveries for PBDE's which were present in the native sample at a concentration greater than five times the amount spiked were unable to be calculated and are reported as NC (not calculated) on the final report sheets. Recoveries were also unable to be calculated in cases where the amount recovered in the native sample exceeded that which was found in the spiked sample. In these instances results were also reported NC.

Laboratory Control Sample

LCS sample OL06005T1 was analyzed with the sample set. All compounds met established QC recovery guidelines of 70% - 130%.

Surrogates

All surrogates fell within established QC recovery limits of 50% - 150%.

Internal Standards

All internal standards fell within established QC limits of 50% - 200%.

Laboratory Duplicates

Sample 05494235 was utilized for duplicate analysis. All detected compounds had RPD's ≤40%.

Please call Dolores Montgomery at (360) 871-8818 to further discuss this project.

cc: Project File

Manchester Environmental Laboratory
7411 Beach Dr E, Port Orchard, Washington 98366

Case Narrative

February 23, 2006

Subject: Spokane River Fish – Batch 3

Project No: 188005

Sample No: 05494243 – 05494245, 05494247 – 05494248, 05494251 – 05494260, 05494275, 05494277

Project Officer: Dave Serdar

By: Dolores Montgomery

Summary

The samples were analyzed using the following method: EPA method 8270 for PBDE analysis.

All analyses requested were evaluated by established regulatory quality assurance guidelines.

Holding Times

All samples were analyzed within the method holding times.

Tuning

Calibration against DFTPP is acceptable for the initial calibration and all associated sample analyses.

Initial Calibration

All compounds met minimum response factor criteria and had calibration curves which had %RSD ≤15, linear correlation coefficients of greater than 0.995, a coefficient of determination greater than 0.99 and had no standard vary from its true value by more than 20%.

Continuing Calibration

All compounds fell within ±20%D of the continuing calibration with the following exception. PBDE 209 displayed an increase in response in the continuing calibration analyzed on January 26th. The analyte was not detected in any samples analyzed on this date and no qualifiers were necessary.

Method Blanks

No target analytes were detected in the method blanks.

Matrix Spikes

A matrix spike was performed on sample 05494256. All recoveries fell within the established QC recovery limits of 50% - 150% with the following exceptions. Recovery for PBDE 99 was low with a recovery of 44%. Results for this compound were qualified J in native sample 05494256. Recoveries for PBDE 49, 47, 100, 154, and 153were not able to be calculated due to the high levels of these spiked analytes found in the native sample.

Laboratory Control Sample

LCS sample OL06012T1 was analyzed with the sample set. All compounds met established QC recovery guidelines of 70% - 130%.

Surrogates

All surrogates fell within established QC recovery limits of 50% - 150% with a few exceptions. Several surrogate recoveries were low in the dilution analysis run for a sample. In all cases the initial sample analysis resulted in an acceptable surrogate recovery. The low surrogate recovery in the diluted analysis is the result of the surrogate being diluted below the level of the calibration curve. No qualifiers were assigned in cases where surrogate recovery fell below 50% in a diluted analysis which resulted in the surrogate falling below its lower quantitation level.

Internal Standards

All internal standards fell within established QC limits of 50% - 200%.

Laboratory Duplicates

Samples 05494245, 05494248, and 05494251 were utilized for duplicate analysis. All detected compounds had RPD's ≤40% between 05494245 and 05494245D with the exception of PBDE 49 and PBDE 99. Results for these two analytes were qualified J in both samples. All RPD's were ≤40% between samples 05494248 and 05494248D and between samples 05494251 and 05494251D.

Please call Dolores Montgomery at (360) 871-8818 to further discuss this project.

cc: Project File

Manchester Environmental Laboratory
7411 Beach Dr E, Port Orchard, Washington 98366

Case Narrative

December 19, 2005

Subject: Metals 2005 Spokane River Fish

Project No: 188005

Officer: Dave Serdar

By: Dean Momohara

Summary

The samples were digested and analyzed using the following methods: EPA method 3051 (microwave) and EPA method 200.8 (ICPMS) for the digestion and analysis of metals, respectively.

All analyses requested were evaluated by established regulatory quality assurance guidelines.

Sample Information

Samples were received by Manchester Environmental Laboratory on 12/12/05. All coolers were received frozen. The samples were received in good condition. Forty eight (48) samples were received and assigned laboratory identification numbers 494230 - 494277.

Holding Times

All analyses were performed within established EPA holding times.

Calibration

Instrument calibrations and calibration checks were performed in accordance with the appropriate method. All initial and continuing calibration checks were within control limits. The calibration correlation coefficients were within the acceptance range of 1.000 - 0.995. The instruments were calibrated with NIST traceable standards and verified to be in calibration with a second source NIST traceable standard.

Method Blanks

No analytically significant levels of analyte were detected in the method blanks associated with these samples.

Matrix Spikes

The matrix spike (MS) recovery for sample 494256 was less than the lower acceptance limit. The standard spiking level was insufficient for the elevated concentration of analyte in the source sample and no action was taken. All other MS recoveries were within the acceptance limits of 75% - 125%.

Replicates

The duplicate relative percent differences (RPD) for sample 494245 for zinc and lead analyses were greater than the acceptance limit. The source sample was qualified as an estimate. All other duplicate RPDs of samples with concentrations greater than 5 times the reporting limit were within the acceptance range of 0% - 20%.

Laboratory Control Samples

All laboratory control sample recoveries were within the acceptance limits of 85% - 115%.

A certified reference material DORM – 2 was analyzed with each batch. Analytes with concentration less than the reporting limit or with no certified value were not calculated.

Other Quality Assurance Measures and Issues

All internal standard recoveries were within acceptance limits.

U - The analyte was not detected at or above the reported result.

J - The analyte was positively identified. The associated numerical result is an estimate.

NC - Not Calculated

bold - The analyte was present in the sample. (Visual Aid to locate detected compounds on report sheet.)

Please call Dean Momohara at (360) 871-8808 to further discuss this project.
cc: Project File

Manchester Environmental Laboratory
7411 Beach Dr E, Port Orchard, Washington 98366

Case Narrative

January 25, 2006

Subject: Organic Chemistry Spokane River Fish 2005

Project No: 188005

Officer: Dave Serdar

By: Dean Momohara

Summary

The samples were analyzed by the following method: SOP700009 for lipids.

The analysis requested was evaluated by established regulatory quality assurance guidelines.

Sample Information

Samples were received by Manchester Environmental Laboratory on 12/12/05. All samples were received in good condition. Forty eight (48) samples were received and assigned laboratory identification numbers 494230 - 494277.

Holding Times

The analysis was performed within established EPA holding times.

Calibration

Balances are check prior to daily use.

Method Blanks

No analytically significant levels of analyte were detected in the method blanks associated with these samples.

Matrix Spikes

NA

Replicates

Except for the duplicate relative difference for sample 494245, the relative percent differences of samples were within the acceptance range of 0% - 20%.

Laboratory Control Samples

NA

Other Quality Assurance Measures and Issues

U - The analyte was not detected at or above the reported result.

bold - The analyte was present in the sample. (Visual Aid to locate detected compounds on report sheet.)

Please call Dean Momohara at (360) 871-8808 to further discuss this project.

cc: Project File

Appendix D – 2005 Spokane River Fish Tissue Chemical Data

Table D. Spokane River 2005 Fish Tissue Data, Sorted by Location

Waterbody/Location	Station	RM	Species	Mean Length (mm)	Mean Weight (gm)	Mean Fish Age	Tissue	Sample No.	No. Indiv. per Comp.	Sum PCB (ng/g)	Sum PBDE (ng/g)	As (ug/g)	Cd (ug/g)	Pb (ug/g)	Zn (ug/g)	Lipid (%)
Stateline	SPK 96.0	96.0	LSS	516	1,311	9.8	Whole	05494245	5	77.0	212.1	0.16	0.24	3.14	87	10.13
Stateline	SPK 96.0	96.0	LSS	470	1,096	6.4	Whole	05494246	5	74.4	168.7	0.24	0.2	6.7	165	9.63
Stateline	SPK 96.0	96.0	LSS	444	960	7.0	Whole	05494247	5	15.5	214.4	0.19	0.16	2.61	90.6	10.36
Plante Ferry	SPK 85.0	85.0	RBT	451	871	3.2	Fillet	05494230	5	68.0	99.7	0.10 U	0.10 U	0.14	12	3.2
Plante Ferry	SPK 85.0	85.0	RBT	383	553	2.6	Fillet	05494231	5	48.6	106.7	0.10 U	0.10 U	0.11	16	3.58
Plante Ferry	SPK 85.0	85.0	RBT	328	344	1.8	Fillet	05494232	5	48.0	65.3	0.10 U	0.10 U	0.10 U	17	3.39
Plante Ferry	SPK 85.0	85.0	LSS	532	1,421	8.6	Whole	05494248	5	180.0	252.2	0.18	0.24	2.91	71.1	4.8
Plante Ferry	SPK 85.0	85.0	LSS	484	1,093	7.2	Whole	05494249	5	90.9	127.7	0.26	0.19	2.63	73.1	6.06
Plante Ferry	SPK 85.0	85.0	LSS	451	958	5.6	Whole	05494250	5	94.4	83.5	0.34	0.17	3.24	92.7	6.25
Mission Park	SPK 75.2	75.2	RBT	274	192	1.8	Fillet	05494261	5	220.0	31.6	0.10 U	0.10 U	0.10 U	14	1.35
Mission Park	SPK 75.2	75.2	RBT	335	349	2.4	Fillet	05494262	5	121.0	27.4	0.10 U	0.10 U	0.10 U	9.9	1.47
Mission Park	SPK 75.2	75.2	RBT	381	517	3.6	Fillet	05494263	5	118.0	32.2	0.10 U	0.10 U	0.14	13	1.53
Mission Park	SPK 77.0	77.0	MWF	347	414	4.8	Fillet	05494264	5	280.0	357.6	0.10 U	0.10 U	0.19	13	7.8
Mission Park	SPK 77.0	77.0	MWF	360	435	5.6	Fillet	05494265	5	220.0	391.3	0.10 U	0.10 U	0.10 U	14	6
Mission Park	SPK 77.0	77.0	MWF	374	502	6.0	Fillet	05494266	5	203.0	355.0	0.10 U	0.10 U	0.10 U	13	6.69
Mission Park	SPK 75.2	75.2	LSS	501	1,260	11.0	Whole	05494251	5	1,369.0	97.8	0.16	0.2	4.2	56.4	3.04
Mission Park	SPK 75.2	75.2	LSS	455	920	8.0	Whole	05494252	5	3,000.0	96.6	0.33	0.19	3.36	57.5	4.76
Mission Park	SPK 75.2	75.2	LSS	414	686	7.6	Whole	05494253	5	1,100.0	89.5	0.29	0.16	2.82	54.3	3.69
Ninemile	SPK 64.0	64.0	RBT	305	291	1.2	Fillet	05494269	5	45.7	291.9	0.10 U	0.10 U	0.10 U	8	1.99
Ninemile	SPK 64.0	64.0	RBT	351	415	2.6	Fillet	05494270	5	78.0	397.5	0.10 U	0.10 U	0.26	11	2.02
Ninemile	SPK 64.0	64.0	RBT	406	592	2.8	Fillet	05494272	5	94.0	563.8	0.10 U	0.10 U	0.10 U	12	2.14
Ninemile	SPK 64.0	64.0	MWF	292	223	2.8	Fillet	05494267	5	160.0	905.1	0.10 U	0.10 U	0.10 U	12	3.8
Ninemile	SPK 64.0	64.0	MWF	321	309	3.4	Fillet	05494268	5	86.0	1,049.1	0.10 U	0.10 U	0.10 U	13	3.59
Ninemile	SPK 64.0	64.0	MWF	349	365	6.0	Fillet	05494271	5	172.0	1,222.1	0.10 U	0.10 U	0.10 U	11	3.29
Ninemile	SPK 64.0	64.0	BLS	441	905	8.0	Fillet*	05494257	5	28.1	76.0	0.10	0.10 U	0.24	23	1.47
Ninemile	SPK 64.0	64.0	BLS	441	905	8.0	Carcass*	05494258	5	62.7	442.2	0.51	0.23	4.14	71.3	4.71
Ninemile	SPK 64.0	64.0	BLS	425	839	7.3	Whole	05494259	4	94.1	708.3	0.28	0.13	2.61	88.6	4.61
Ninemile	SPK 64.0	64.0	BLS	405	776	6.4	Whole	05494260	5	59.8	522.9	0.38	0.14	3.14	70.8	5.17
Upper Long Lake	SPK 55.6	55.6	MWF	318	328	5.8	Fillet	05494239	5	55.0	198.2	0.12	0.10 U	0.10 U	16	2.9
Upper Long Lake	SPK 55.6	55.6	MWF	282	219	2.4	Fillet	05494240	5	36.0	167.0	0.10 U	0.10 U	0.10 U	11	2.56
Upper Long Lake	SPK 55.6	55.6	MWF	256	142	1.2	Fillet	05494241	5	38.4	160.9	0.10 U	0.10 U	0.10 U	9.3	1.56
Upper Long Lake	SPK 55.2	55.2	BRT	451	964	2.5	Fillet	05494276	2	130.0	159.3	0.10	0.10 U	0.10 U	6	2.62
Upper Long Lake	SPK 55.6	55.6	SMBS	369	810	4.0	Fillet	05494277	4	36.9	41.8	0.11	0.10 U	0.10 U	7.8	1.3
Upper Long Lake	SPK 55.6	55.6	LSS	438	853	10.2	Whole	05494254	5	312.0	537.9	0.13	0.10 U	0.56	37	3.54
Upper Long Lake	SPK 55.6	55.6	LSS	461	1,052	11.8	Whole	05494255	5	510.0	718.0	0.20	0.10 U	1.25	62	4.42
Upper Long Lake	SPK 55.6	55.6	LSS	487	1,202	11.8	Whole	05494256	5	160.0	458.9	0.11	0.10 U	0.6	25	3.88

Table D. (Cont'd). Spokane River 2005 Fish Tissue Data, Sorted by Location

Waterbody/Location	Station	RM	Species	Mean Length (mm)	Mean Weight (gm)	Mean Fish Age	Tissue	Sample No.	No. Indiv. per Comp.	Sum PCB (ng/g)	Sum PBDE (ng/g)	As (ug/g)	Cd (ug/g)	Pb (ug/g)	Zn (ug/g)	Lipid (%)
Lower Long Lake	SPK 40.1	40.1	MWF	368	544	5.0	Fillet	05494233	1	41.0	129.2	0.26	0.10 U	0.10 U	6.3	1.71
Lower Long Lake	SPK 40.1	40.1	MWF	356	536	4.0	Fillet	05494234	1	9.6 U	87.9	0.34	0.10 U	0.10 U	7.3	2.65
Lower Long Lake	SPK 40.1	40.1	MWF	365	524	7.0	Fillet	05494235	1	16.3	56.4	0.38	0.10 U	0.10 U	6.4	2.65
Lower Long Lake	SPK 40.1	40.1	MWF	365	573	11.0	Fillet	05494236	1	70.2	117.0	0.25	0.10 U	0.10 U	8.3	2.6
Lower Long Lake	SPK 40.1	40.1	MWF	341	413	3.0	Fillet	05494237	1	130.0	110.4	0.37	0.10 U	0.10 U	6.3	3.48
Lower Long Lake	SPK 40.1	40.1	MWF	349	468	5.0	Fillet	05494238	1	190.0	228.1	0.23	0.10 U	0.10 U	7.9	2.52
Lower Long Lake	SPK 40,8	40.8	SMBS	340	581	3.4	Fillet	05494273	5	49.0	33.6	0.14	0.10 U	0.10 U	8.8	1.5
Lower Long Lake	SPK 40,8	40.8	SMBS	378	909	4.0	Fillet	05494274	5	82.0	43.9	0.16	0.10 U	0.10 U	8.2	1.99
Lower Long Lake	SPK 40,8	40.8	SMBS	423	1,206	5.8	Fillet	05494275	5	71.2	92.4	0.10	0.10 U	0.10 U	7.8	2.2
Lower Long Lake	SPK 40.1	40.1	LSS	491	1,431	10.8	Whole	05494242	5	257.0	147.9	0.23	0.10 U	0.29	24	6.4
Lower Long Lake	SPK 40.1	40.1	LSS	407	790	4.0	Whole	05494243	5	109.0	89.8	0.18	0.10 U	0.14	18	5.16
Lower Long Lake	SPK 40.1	40.1	LSS	460	1,201	9.4	Whole	05494244	5	396.0	357.4	0.26	0.10 U	0.57	31	7.05

BLS=bridgelip sucker
BRT=brown trout
LSS=largescale sucker
MWF=mountain whitefish
RBT=rainbow trout
SMBS=smallmouth bass
U=undetected at concentration shown

										Sum PCB	Sum PBDE	As	Cd	Pb	Zn	Pct. Lipid
* Whole fish concentrations calculated from weighted fillet and carcass concentrations =										52.4	373.4	0.39	0.18	2.98	57.0	3.75

Appendix E – Historical Data on PCBs in Spokane River Fish

Table E. Historical Data on PCBs in Spokane River Fish (ug/Kg, ww).

Location	Species	Year	Tissue	Composite?	Sample ID	Analysis	T-PCB	Frx Lipid	Latitude	Longitude
Stateline	RBT	1999	Fillet	N	99485000	Aroclor	85	0.028	47.6985	-117.0446
Stateline	RBT	1999	Fillet	N	99485001	Aroclor	133	0.04	47.6985	-117.0446
Stateline	RBT	1999	Fillet	N	99485002	Aroclor	105	0.041	47.6985	-117.0446
Stateline	RBT	1999	Fillet	N	99485003	Aroclor	133	0.036	47.6985	-117.0446
Stateline	RBT	1999	Fillet	N	99485004	Aroclor	74	0.061	47.6985	-117.0446
Stateline	RBT	1999	Whole	Y	99485005	Aroclor	77	0.083	47.6985	-117.0446
Stateline	LSS	1999	Whole	Y	99485006	Aroclor	120	0.061	47.6985	-117.0446
Stateline	LSS	1999	Fillet	N	99485007	Aroclor	342	0.019	47.6985	-117.0446
Stateline	LSS	1999	Fillet	N	99485008	Aroclor	62	0.015	47.6985	-117.0446
Stateline	LSS	1999	Fillet	N	99485009	Aroclor	61	0.017	47.6985	-117.0446
Stateline	LSS	1999	Fillet	N	99485010	Aroclor	6	0.001	47.6985	-117.0446
Stateline	LSS	1999	Fillet	N	99485011	Aroclor	21	0.042	47.6985	-117.0446
Stateline	LSS	2004	Whole	Y	4324443	Congener	59	0.034	47.6981	-117.0435
Stateline	LSS	2004	Whole	Y	4324442	Congener	142	0.045	47.6981	-117.0435
Plante Ferry	RBT	1993	Fillet		93318255	Aroclor	1,084	0.019	47.6977	-117.2450
Plante Ferry	RBT	1993	Fillet		93318256	Aroclor	950	0.017	47.6977	-117.2450
Plante Ferry	RBT	1993	Fillet	Y	93378092	Aroclor	720	0.0269	47.6932	-117.2366
Plante Ferry	RBT	1994	Fillet		94318260	Aroclor	383	0.029	47.6977	-117.2450
Plante Ferry	RBT	1994	Fillet		94318260-dup	Aroclor	387	na	47.6977	-117.2450
Plante Ferry	RBT	1994	Fillet		94318261	Aroclor	740	0.025	47.6977	-117.2450
Plante Ferry	RBT	1994	Fillet		94328437 (dup. of 94318261)	Aroclor	471	0.028	47.6977	-117.2450
Plante Ferry	RBT	1994	Fillet		94318262	Aroclor	280	0.037	47.6977	-117.2450
Plante Ferry	RBT	1996	Fillet	Y	96428096	Aroclor	1,870	0.022	47.6977	-117.2450
Plante Ferry	RBT	1996	Fillet	Y	96428097	Aroclor	313	0.024	47.6977	-117.2450
Plante Ferry	RBT	1996	Fillet	Y	96428098	Aroclor	215	0.022	47.6977	-117.2450
Plante Ferry	RBT	1999	Fillet	N	99485013	Aroclor	1,353	0.034	47.6970	-117.2457
Plante Ferry	RBT	1999	Fillet	N	99485013-dup	Aroclor	1,248	0.03	47.6970	-117.2457
Plante Ferry	RBT	1999	Fillet	N	99485014	Aroclor	70	0.047	47.6970	-117.2457
Plante Ferry	RBT	1999	Fillet	N	99485015	Aroclor	1,610	0.02	47.6970	-117.2457
Plante Ferry	RBT	1999	Fillet	N	99485016	Aroclor	100	0.028	47.6970	-117.2457
Plante Ferry	RBT	1999	Fillet	N	99485017	Aroclor	1,320	0.045	47.6970	-117.2457
Plante Ferry	RBT	2003	Fillet	Y	4188309	Congener	28	0.017	47.6946	-117.2393

Table E. (Cont'd). Historical Data on PCBs in Spokane River Fish (ug/Kg, ww).

Location	Species	Year	Tissue	Composite?	Sample ID	Analysis	T-PCB	Frx Lipid	Latitude	Longitude
Plante Ferry	RBT	2003	Fillet	Y	4188308	Congener	41	0.017	47.6946	-117.2393
Plante Ferry	RBT	1999	Whole	Y	99485012	Aroclor	755	0.077	47.6970	-117.2457
Plante Ferry	LSS	1993	Whole	N	93318243	Aroclor	2,005	0.043	47.6977	-117.2450
Plante Ferry	LSS	1994	Whole		94318263	Aroclor	531	0.036	47.6977	-117.2450
Plante Ferry	LSS	1996	Whole	Y	96428099	Aroclor	530	0.037	47.6977	-117.2450
Plante Ferry	LSS	1999	Whole	Y	99485018	Aroclor	283	0.045	47.6970	-117.2457
Plante Ferry	LSS	2003	Whole	Y	4324440	Congener	140	0.046	47.6946	-117.2393
Plante Ferry	LSS	2003	Whole	Y	4324441	Congener	54	0.033	47.6946	-117.2393
Plante Ferry	LSS	1999	Fillet	N	99485019	Aroclor	207	0.019	47.6970	-117.2457
Plante Ferry	LSS	1999	Fillet	N	99485020	Aroclor	215	0.027	47.6970	-117.2457
Plante Ferry	LSS	1999	Fillet	N	99485021	Aroclor	67	0.024	47.6970	-117.2457
Plante Ferry	LSS	1999	Fillet	N	99485022	Aroclor	60	0.006	47.6970	-117.2457
Plante Ferry	LSS	1999	Fillet	N	99485023	Aroclor	191	0.016	47.6970	-117.2457
Mission Park	RBT	1994	Fillet		94328425	Aroclor	164	0.012	47.6793	-117.3709
Mission Park	RBT	1994	Fillet		94328426	Aroclor	111	0.011	47.6793	-117.3709
Mission Park	RBT	1994	Fillet		94328427	Aroclor	161	0.012	47.6793	-117.3709
Mission Park	RBT	1996	Fillet	Y	96428093	Aroclor	73	0.015	47.6793	-117.3709
Mission Park	RBT	1996	Fillet	Y	96428094	Aroclor	78	0.011	47.6793	-117.3709
Mission Park	RBT	1999	Fillet	N	99485024	Aroclor	136	0.012	47.6785	-117.3638
Mission Park	RBT	1999	Fillet	N	99485025	Aroclor	325	0.029	47.6785	-117.3638
Mission Park	RBT	1999	Fillet	N	99485026	Aroclor	398	0.022	47.6785	-117.3638
Mission Park	RBT	1999	Fillet	N	99485027	Aroclor	143	0.011	47.6785	-117.3638
Mission Park	RBT	1999	Fillet	N	99485028	Aroclor	126	0.018	47.6785	-117.3638
Mission Park	RBT	1999	Whole	Y	99485029	Aroclor	362	0.043	47.6785	-117.3638
Mission Park	MWF	1994	Fillet		94328428	Aroclor	530	0.056	47.6793	-117.3709
Mission Park	MWF	1994	Fillet		94328429	Aroclor	449	0.055	47.6793	-117.3709
Mission Park	MWF	1994	Fillet		94328430	Aroclor	725	0.046	47.6793	-117.3709
Mission Park	MWF	1996	Fillet	Y	96428091	Aroclor	398	0.042	47.6793	-117.3709
Mission Park	MWF	1996	Fillet	Y	96428092	Aroclor	364	0.039	47.6793	-117.3709
Mission Park	MWF	1999	Fillet	N	99485030	Aroclor	478	0.083	47.6785	-117.3638
Mission Park	MWF	1999	Fillet	N	99485031	Aroclor	338	0.082	47.6785	-117.3638
Mission Park	MWF	1999	Fillet	N	99485032	Aroclor	335	0.058	47.6785	-117.3638

Table E. (Cont'd). Historical Data on PCBs in Spokane River Fish (ug/Kg, ww).

Location	Species	Year	Tissue	Composite?	Sample ID	Analysis	T-PCB	Frx Lipid	Latitude	Longitude
Mission Park	MWF	1999	Fillet	N	99485033	Aroclor	380	0.074	47.6785	-117.3638
Mission Park	MWF	1999	Fillet	N	99485034	Aroclor	162	0.091	47.6785	-117.3638
Mission Park	MWF	1999	Whole	Y	99485035	Aroclor	397	0.167	47.6785	-117.3638
Mission Park	LSS	1994	Whole		94328431	Aroclor	201	0.012	47.6793	-117.3709
Mission Park	LSS	1996	Whole	Y	96428095	Aroclor	116	0.008	47.6793	-117.3709
Mission Park	LSS	1999	Whole	Y	99485041	Aroclor	449	0.025	47.6785	-117.3638
Mission Park	LSS	1999	Whole	Y	99485041-dup	Aroclor	440	na	47.6785	-117.3638
Mission Park	LSS	1999	Fillet	N	99485036	Aroclor	144	0.012	47.6785	-117.3638
Mission Park	LSS	1999	Fillet	N	99485037	Aroclor	429	0.008	47.6785	-117.3638
Mission Park	LSS	1999	Fillet	N	99485038	Aroclor	92	0.007	47.6785	-117.3638
Mission Park	LSS	1999	Fillet	N	99485039	Aroclor	193	0.017	47.6785	-117.3638
Mission Park	LSS	1999	Fillet	N	99485040	Aroclor	88	0.006	47.6785	-117.3638
Ninemile	RBT	1993	Fillet		93318252	Aroclor	505	0.029	47.7445	-117.5246
Ninemile	RBT	1993	Fillet		93318253	Aroclor	474	0.027	47.7445	-117.5246
Ninemile	RBT	1994	Fillet		94318254	Aroclor	320	0.054	47.7445	-117.5246
Ninemile	RBT	1994	Fillet		94318255	Aroclor	205	0.03	47.7445	-117.5246
Ninemile	RBT	1994	Fillet		94318256	Aroclor	589	0.052	47.7445	-117.5246
Ninemile	RBT	1996	Fillet	Y	96428084	Aroclor	63	0.015	47.7445	-117.5246
Ninemile	RBT	1996	Fillet	Y	96428085	Aroclor	128	0.017	47.7445	-117.5246
Ninemile	RBT	1996	Fillet	Y	96428086	Aroclor	38	0.015	47.7445	-117.5246
Ninemile	RBT	1999	Fillet	N	99485043	Aroclor	363	0.006	47.7407	-117.5196
Ninemile	RBT	1999	Fillet	N	99485044	Aroclor	75	0.003	47.7407	-117.5196
Ninemile	RBT	1999	Fillet	N	99485045	Aroclor	65	0.006	47.7407	-117.5196
Ninemile	RBT	1999	Fillet	N	99485046	Aroclor	86	0.006	47.7407	-117.5196
Ninemile	RBT	1999	Fillet	N	99485047	Aroclor	139	0.009	47.7407	-117.5196
Ninemile	RBT	1999	Fillet	N	99485048	Aroclor	185	0.032	47.7407	-117.5196
Ninemile	RBT	1999	Fillet	N	99485049	Aroclor	85	0.023	47.7407	-117.5196
Ninemile	RBT	1999	Whole	Y	99485042	Aroclor	221	0.021	47.7407	-117.5196
Ninemile	RBT	2003	Fillet	N	3084299	Congener	17	0.002	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084293	Congener	27	0.018	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084284	Congener	34	0.019	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084304	Congener	10	0.003	47.7324	-117.5096

Table E. (Cont'd). Historical Data on PCBs in Spokane River Fish (ug/Kg, ww).

Location	Species	Year	Tissue	Composite?	Sample ID	Analysis	T-PCB	Frx Lipid	Latitude	Longitude
Ninemile	RBT	2003	Fillet	N	3084290	Congener	75	0.033	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084288	Congener	17	0.019	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084281	Congener	10	0.015	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084305	Congener	12	0.005	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084291	Congener	52	0.025	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084303	Congener	29	0.009	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084301	Congener	43	0.015	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084296	Congener	11	0.004	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084285	Congener	51	0.011	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084298	Congener	16	0.009	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084292	Congener	45	0.02	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084295	Congener	15	0.006	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084306	Congener	35	0.016	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084294	Congener	10	0.01	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084283	Congener	13	0.013	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084289	Congener	42	0.007	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084302	Congener	20	0.008	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084308 (dup. of 03084282)	Congener	59	0.028	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084282	Congener	53	0.026	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084287	Congener	12	0.004	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084286	Congener	12	0.01	47.7324	-117.5096
Ninemile	MWF	1993	Fillet		93318254	Aroclor	522	0.027	47.7445	-117.5246
Ninemile	MWF	1994	Fillet		94318257	Aroclor	120	0.069	47.7445	-117.5246
Ninemile	MWF	1994	Fillet		94318258	Aroclor	111	0.084	47.7445	-117.5246
Ninemile	MWF	1994	Fillet		94318259	Aroclor	185	0.066	47.7445	-117.5246
Ninemile	MWF	1996	Fillet	Y	96428087	Aroclor	560	0.045	47.7445	-117.5246
Ninemile	MWF	1996	Fillet	Y	96428088	Aroclor	430	0.055	47.7445	-117.5246
Ninemile	MWF	1996	Fillet	Y	96428089	Aroclor	343	0.051	47.7445	-117.5246
Ninemile	MWF	1999	Fillet	N	99485050	Aroclor	291	0.039	47.7407	-117.5196
Ninemile	MWF	1999	Fillet	N	99485051	Aroclor	483	0.072	47.7407	-117.5196
Ninemile	MWF	1999	Fillet	N	99485052	Aroclor	172	0.037	47.7407	-117.5196
Ninemile	MWF	1999	Fillet	N	99485053	Aroclor	1,490	0.062	47.7407	-117.5196

Table E. (Cont'd). Historical Data on PCBs in Spokane River Fish (ug/Kg, ww).

Location	Species	Year	Tissue	Composite?	Sample ID	Analysis	T-PCB	Frx Lipid	Latitude	Longitude
Ninemile	MWF	1999	Fillet	N	99485053-dup	Aroclor	2,170	na	47.7407	-117.5196
Ninemile	MWF	1999	Fillet	N	99485054	Aroclor	386	0.038	47.7407	-117.5196
Ninemile	MWF	1999	Whole	Y	99485055	Aroclor	930	0.149	47.7407	-117.5196
Ninemile	LSS	1993	Whole		93318242	Aroclor	1,210	0.056	47.7445	-117.5246
Ninemile	LSS	1996	Whole	Y	96428090	Aroclor	345	0.021	47.7445	-117.5246
Ninemile	LSS	1999	Whole	Y	99485061	Aroclor	680	0.022	47.7407	-117.5196
Ninemile	LSS	1999	Fillet	N	99485056	Aroclor	100	0.008	47.7407	-117.5196
Ninemile	LSS	1999	Fillet	N	99485057	Aroclor	154	0.013	47.7407	-117.5196
Ninemile	LSS	1999	Fillet	N	99485058	Aroclor	247	0.03	47.7407	-117.5196
Ninemile	LSS	1999	Fillet	N	99485059	Aroclor	113	0.026	47.7407	-117.5196
Ninemile	LSS	1999	Fillet	N	99485059-dup	Aroclor	70	na	47.7407	-117.5196
Ninemile	LSS	1999	Fillet	N	99485060	Aroclor	142	0.026	47.7407	-117.5196
Ninemile	BLS	2004	Whole	Y	4324450	Congener	28	0.048	47.7430	-117.5216
Ninemile	BLS	2004	Whole	Y	4324447	Congener	32	0.027	47.7430	-117.5216
Ninemile	BLS	2004	Whole	Y	4324448 (dup. of 04324447)	Congener	30	0.025	47.7430	-117.5216
Up.Long Lk.	MWF	2001	Fillet	Y	2158308	Aroclor	89	0.0188	47.7966	-117.5858
Up.Long Lk.	MWF	2001	Fillet	Y	2158309	Aroclor	60	0.0153	47.7966	-117.5858
Up.Long Lk.	MWF	2001	Fillet	Y	2158310	Aroclor	70	0.0183	47.7966	-117.5858
Up.Long Lk.	LMBS	2001	Fillet	Y	2158306	Aroclor	39	0.0061	47.7966	-117.5858
Up.Long Lk.	LMBS	2001	Fillet	Y	2158307	Aroclor	72	0.0076	47.7966	-117.5858
Up.Long Lk.	LMBS	2001	Fillet	Y	2158311	Aroclor	39	0.0033	47.7966	-117.5858
Up.Long Lk.	LSS	2001	Whole	N	2138283	Aroclor	336	0.0402	47.7966	-117.5858
Up.Long Lk.	LSS	2001	Whole	N	2138284	Aroclor	294	0.0552	47.7966	-117.5858
Up.Long Lk.	LSS	2001	Whole	N	2138285	Aroclor	164	0.0146	47.7966	-117.5858
Up.Long Lk.	LSS	2001	Fillet	Y	2138280	Aroclor	112	0.0183	47.7966	-117.5858
Up.Long Lk.	LSS	2001	Fillet	Y	2138286	Aroclor	86	0.0155	47.7966	-117.5858
Up.Long Lk.	LSS	2001	Fillet	Y	2138287	Aroclor	132	0.0189	47.7966	-117.5858
Up.Long Lk.	LSS	2001	Fillet	Y	2138291	Aroclor	32	0.0046	47.7966	-117.5858
Up.Long Lk.	LSS	2001	Fillet	Y	2138292	Aroclor	40	0.0043	47.7966	-117.5858
Up.Long Lk.	LSS	2001	Fillet	Y	2138293	Aroclor	54	0.0069	47.7966	-117.5858
Up.Long Lk.	LSS	2001	Fillet	Y	2148300	Aroclor	11 (U)	0.0026	47.7966	-117.5858
Up.Long Lk.	LSS	2001	Fillet	Y	2148301	Aroclor	11 (U)	0.0035	47.7966	-117.5858

Table E. (Cont'd). Historical Data on PCBs in Spokane River Fish (ug/Kg, ww).

Location	Species	Year	Tissue	Composite?	Sample ID	Analysis	T-PCB	Frx Lipid	Latitude	Longitude
Up.Long Lk.	LSS	2001	Fillet	Y	2148302	Aroclor	11 (U)	0.0033	47.7966	-117.5858
Lw.Long Lk.	MWF	1993	Fillet		93318250	Aroclor	780	0.035	47.8404	-117.7289
Lw.Long Lk.	MWF	1994	Fillet		94318249	Aroclor	150	0.036	47.8404	-117.7289
Lw.Long Lk.	MWF	1994	Fillet		94318250	Aroclor	118	0.034	47.8404	-117.7289
Lw.Long Lk.	MWF	1994	Fillet		94318251	Aroclor	71	0.019	47.8404	-117.7289
Lw.Long Lk.	LMBS	1993	Fillet		93318249	Aroclor	97	0.006	47.8404	-117.7289
Lw.Long Lk.	LMBS	1994	Fillet		94318240	Aroclor	94	0.01	47.8404	-117.7289
Lw.Long Lk.	LMBS	1994	Fillet		94318247	Aroclor	104	0.011	47.8404	-117.7289
Lw.Long Lk.	LMBS	2001	Fillet	Y	2158303	Aroclor	47	0.0041	47.8094	-117.7962
Lw.Long Lk.	LMBS	2001	Fillet	Y	2158304	Aroclor	64	0.0062	47.8094	-117.7962
Lw.Long Lk.	LMBS	2001	Fillet	Y	2158305	Aroclor	57	0.0032	47.8094	-117.7962
Lw.Long Lk.	SMBS	2001	Fillet	Y	2138294	Aroclor	33	0.0017	47.8094	-117.7962
Lw.Long Lk.	SMBS	2001	Fillet	Y	2138295	Aroclor	11 (U)	0.0009	47.8094	-117.7962
Lw.Long Lk.	SMBS	2001	Fillet	Y	2138296	Aroclor	31	0.0023	47.8094	-117.7962
Lw.Long Lk.	YPER	1993	Fillet		93318251	Aroclor	9	0.002	47.8404	-117.7289
Lw.Long Lk.	YPER	1993	Fillet		93318251	Aroclor	10	0.002	47.8404	-117.7289
Lw.Long Lk.	YPER	1994	Fillet		94318244	Aroclor	9	0.002	47.8404	-117.7289
Lw.Long Lk.	YPER	1994	Fillet		94318245	Aroclor	16	0.002	47.8404	-117.7289
Lw.Long Lk.	YPER	1994	Fillet		94318246	Aroclor	6	0.002	47.8404	-117.7289
Lw.Long Lk.	YPER	2001	Fillet	Y	2138297	Aroclor	10 (U)	0.0013	47.8094	-117.7962
Lw.Long Lk.	YPER	2001	Fillet	Y	2148298	Aroclor	11 (U)	0.0017	47.8094	-117.7962
Lw.Long Lk.	YPER	2001	Fillet	Y	2148299	Aroclor	10 (U)	0.0018	47.8094	-117.7962
Lw.Long Lk.	PKMN	1994	Fillet		94318233	Aroclor	300	0.015	47.8404	-117.7289
Lw.Long Lk.	PKMN	1994	Fillet		94318234	Aroclor	206	0.016	47.8404	-117.7289
Lw.Long Lk.	PKMN	1994	Fillet		94318235	Aroclor	200	0.012	47.8404	-117.7289
Lw.Long Lk.	WHCR	1994	Fillet		94318243	Aroclor	97	0.025	47.8404	-117.7289
Lw.Long Lk.	WHCR	1994	Fillet		94328436 (dup. of 94318243)	Aroclor	98	0.025	47.8404	-117.7289
Lw.Long Lk.	BRT	1994	Fillet		94318241	Aroclor	193	0.04	47.8404	-117.7289
Lw.Long Lk.	LSS	1994	Whole		94318248	Aroclor	820	0.034	47.8404	-117.7289
Lw.Long Lk.	LSS	2001	Whole	N	2138281	Aroclor	393	0.0254	47.8094	-117.7962
Lw.Long Lk.	LSS	2001	Whole	N	2138282	Aroclor	321	0.041	47.8094	-117.7962
Lw.Long Lk.	LSS	2004	Whole	Y	4324446	Congener	253	0.091	47.8277	-117.7452

Table E. (Cont'd). Historical Data on PCBs in Spokane River Fish (ug/Kg, ww).

Location	Species	Year	Tissue	Composite?	Sample ID	Analysis	T-PCB	Frx Lipid	Latitude	Longitude
Lw.Long Lk.	LSS	2004	Whole	Y	4324444	Congener	195	0.077	47.8277	-117.7452
Lw.Long Lk.	LSS	2001	Fillet	Y	2138288	Aroclor	112	0.0192	47.8094	-117.7962
Lw.Long Lk.	LSS	2001	Fillet	Y	2138289	Aroclor	63	0.0148	47.8094	-117.7962
Lw.Long Lk.	LSS	2001	Fillet	Y	2138290	Aroclor	100	0.0186	47.8094	-117.7962

BLS=bridgelip sucker
BRT=brown trout
LMBS=largemouth bass
LSS=largescale sucker
MWF=mountain whitefish
PKMN=northern pikeminnow
RBT=rainbow trout
SMBS=smallmouth bass
WHCR=white crappie
YPER=yellow perch
na=not analyzed
U=undetected at concentration shown